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# AN ANALYSIS OF ENERGY USE AND INPUT COSTS FOR RADISH PRODUCTION IN TURKEY

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***Abstract***

*This research aimed to determine the comparison between the cost of energy and the cost price of producing radishes in Osmaniye Province in Turkey, which is an important source of income in agriculture in Turkey. A questionnaire was used to collect data on radish production from the intended target population 149 radish farms in 2019. The sample was calculated using Neyman's method. Based on a sample size the error was defined as 5 percent for 95 percent reliability. The socio-economic characteristics of the farmers were used to present analysis and also secondary data were also used in the research to deepen our knowledge. The results showed that the input energy was 2,946.574 MJ da$^{-1}$, of which the highest share was related to deep plowing, irrigation, first watering after transplanting, and second plowing with 21.60, 20.07, 19.84 and 12.08%, respectively. The lowest input was belong to Harvest and Packaging with 0.03%. Labor cost (70.75%), fuel cost (14.41%), and material used 14.84%.In addition, the production cost and sales price ( $/ ton) of radish are obtained at 21.69 and 40.21 respectively. We find that the rate of profit from agricultural income was 87.82% while that of energy was 61.38%.*

***Key words*****:** *energy, radish production, input, Turkey*

## INTRODUCTION

Energy is the main driver of human development. The civilization of man is largely the story of progress in energy harnessing, that is, the conversion of energy into a more useful form. Fossil energy is a major resource in agricultural production and is important for the user and supplier of energy in the form of bio-energy in agriculture. According to FAO (2000) [8] energy in agriculture offers significant opportunities for rural development as well as tools to mitigate climate change by replacing fossil fuels with bio-energy. Ozkan et al. (2004) [24] in agriculture, energy is important in terms of agricultural production and agricultural processing for value addition. The increase in trade and production opportunities as a result of rapid population growth, industrialization, urbanization, and globalization increases the demand for energy use and natural resources. Energy use in agriculture is increasing with increasing population, limited arable land, and increasing living standards. These factors have led to an increase in energy inputs, increasing efficiency, and the desire to make things easier by minimizing labor-intensive applications (Akdemir et al, 2012)[3]. Energy plays a key role in economic and social development. Today, there is a lack of leadership in terms of rural energy development policy in agriculture (FAO 2000) [8].

Several methods of energy analysis have been described and include statistical analysis, input-output analysis, and process analysis (Fluck and Baird 1980) [10]. Statistical analysis using global statistics such as fertilizer sales is used to arrive at an estimate of total energy consumption but does not achieve the precision that can be achieved with other methods. The input-output analysis uses a square matrix of energy inputs and is most valid for nationwide analysis. Zucchetto and Bickle (1984) [44] state that input-output analysis can also be used appropriately when

analyzing a farming system with multiple outputs. Process analysis is considered the most appropriate and accurate data analysis method for a single outlet production system and was used in this study. The processes used to produce a crop are identified and analyzed to quantify their respective energy inputs (Fluck and Baiard 1980) [10]. According to Vinten Johansen et al. (1990)[39] the results can then be expressed as energy productivity in terms of joules of energy required per kilogram of crop yield.

The radish is produced in all seasons of the year, although its caloric intake is low, it is rich in vitamins and minerals, and it is eaten fresh and cooked, it is one of the first vegetables produced in the history of humanity, red radish, white radish, horseradish, etc. many different varieties etc. The radish has an important place among vegetables. Turkey radish production is about 7 million tons per year and approximately 200 thousand tons of radishes are produced annually. Turkey's radish cultivation area, production 158,029 ton/2009 and 196,984 ton/2018, and yield development by years (TURKSTAT, 2019; Nermin, 2019) [38, 23].

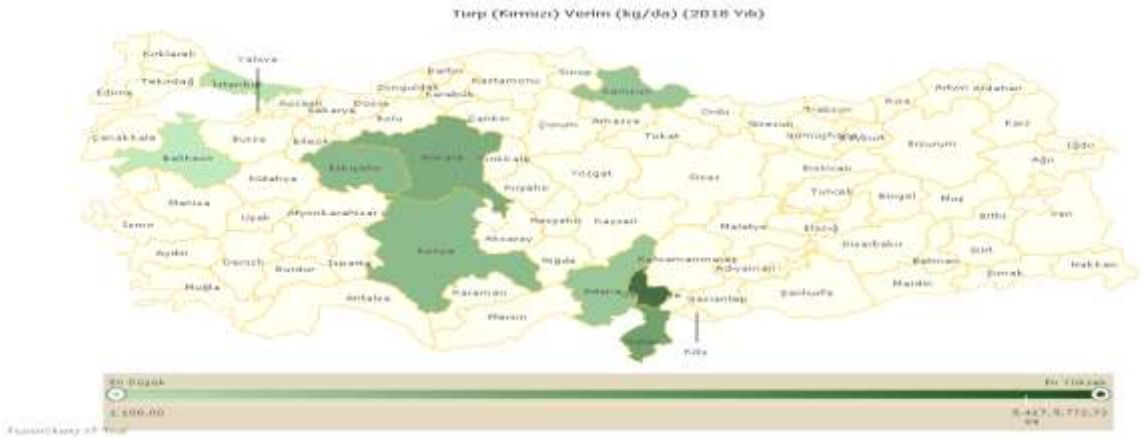
The average annual area of radish cultivation over the past 5 years is 64,000 da. Despite this development of the cultivation area 64,121da /2009-62,931da /2018, the yield of radish has increased over the years. Indeed, the yield which was 2.46 tons/d in 2009 reached 3.13 tons/d in 2018 with an increase of 27%.

The volume of production, on the other hand, grew along with the increase in productivity and increased by 25% compared to 2009, and the average production of the last 5 years was 197,642 tons. The amount of annual radish exports fluctuates over the years, it is on average 780 tons per year. Most of the production is used for domestic consumption. Also, Turkey is self-sufficient in radish production (TÜİKb, 2019) [38].

Map 1 shows us Osmaniye Province ranks first for radish production in Turkey, both in terms of cultivation area and production. The other provinces where the cultivation area is dense such as Samsun (6.01%), Ankara (3.27%), Karaman (2.81%), and Kahramanmaraş (2.77%) (Akdemir and Ismailla, 2022) [2]. In terms of radish yield, it is seen that Osmaniye has higher productivity. Osmaniye province provides 71.19% of Turkey's radish production, which remained stable between 2009 and 2018, production increased from 112,500 tons to 140,225 tons with an increase of 24.64%.

The yield increase was effective and increased from 3.00 kg/day to 3.52 kg/day over the specified period. Osmaniye province is one of the most important livelihoods of radish growers. According to the Ministry of Agriculture and Forestry, radish occupies the first place in the return rates of products grown in many districts of Turkey.

The objective of this research aimed to determine the comparison between the cost of energy and the cost price of producing radishes in Osmaniye.




Map 1. Radish yield by provinces in Turkey
Source: Adapted from TÜİK, 2019 [38].

## MATERIALS AND METHODS

This study is carried out in Osmaniye Province in Turkey. The surveys were conducted among 149 radish producers randomly selected in the villages using the stratified random sampling technique according to the survey method. The sample was calculated using Neyman's method (Yamane, 1967) [42]. The sample size error was set to 5% for 95% confidence (Akdemir et al. 2012) [3]. Primary data and secondary data were used in the study to contribute to the analysis. The calculation of energy inputs is based on the time required for each operation, the number of workers, and the machinery and inputs used (seeds, fertilizers, and chemicals)(Khoshnevisan et al. 2013, Singh, 2002; Mandal, 2002) [13, 36, 17]. Table 1 Energy equivalents of inputs used in radish production. There is a wide variation in energy equivalents used to denote energy input compared to manufacturing means of production in terms of primary energy input (Rathke and Diepenbrock, 2006) [32]. Energy is mainly used in agricultural processes for several activities. Table 1 shows that the total human energy use on each farm was calculated with appropriate conversion factors of 1 man-hour = 1.96 MJ $ha^{-1}$. The mechanical energy used on the selected farms including tractors and diesel engines are calculated based on total fuel consumption (liter $ha^{-1}$). Electric power was used to operate the irrigation pump for transporting water. Various energy efficiency parameters were determined by evaluating the relationship between energy consumption and total production and yield per hectare.

Table 1. Energy equivalents of inputs and outputs

| Items | Unit | Energy content ($MJunit^{-1}$) | Reference |
|---|---|---|---|
| Human labour | h | 1.96 | Houshyar et al. (2017); Mani et al. (2007) [12, 18]. |
| **Machinery** | | | |
| Tractor 50 kw | h | 41.4 | Khoshnevisan et al. (2013); Fluck 1985 [13, 9]. |
| Plough | h | 22.8 | |
| Sprayer | h | 23.8 | |
| Wagon | h | 71.3 | |
| Pump | h | 2.3 | |
| **Fertilizers** | | | |
| N | Kg | 60.60 | Singh, (2002); Mandal, (2002) [36, 17]. |
| P | kg | 11.1 | |
| K | Kg | 6.7 | |
| Insecticides | Kg | 278 | Lal (2004); Dalgaard et al. (2001) [16, 5]. |
| Fungicides | Kg | 276 | Graefe et al. (2013); Wells (2001) [11, 40]. |
| Farmyard manure (dry matter) | Kg | 0.3 | Mohammadi et al. (2014); Shrestha (1998) [20, 34]. |
| Diesel | 1 | 56.31 | Dyer and Desjardins (2006); Pimentel and Pimentel (2007) [6, 28]. |
| Electricity | kwh | 11.93 | Singh, 2002; Mandal, 2002 [36, 17]. |
| Water for irrigation | $m^3$ | 0.63 | Houshyar et al. (2017); yaldiz et al. (1993) [12, 41]. |
| Fruit | Kg | 2.4 | Strapatsa et al. 2006 [37]. |

Source: [3, 12, 18, 13, 9, 36, 17, 16, 5, 11, 40, 20, 34, 6, 28, 36, 17, 41, 37].

Using the formula suggested below in the literature by (Akdemir et al. 2012; Pishgar et al. 2011) [3, 29].

$$\boldsymbol{Energy\ ratio} = \frac{\boldsymbol{Energy\ output\ (Mjha^{-1})}}{\boldsymbol{Energy\ input\ (Mjha^{-1})}} \quad \text{.....(1)}$$

$$Specific\ energy = \frac{Energy\ input\ (Mjha^{-1})}{Output\ (kgha^{-1})} \quad \text{.....(2)}$$

$$Energy\ productivity = \frac{output\ (kgha^{-1})}{Energy\ input\ (Mjha^{-1})} \quad \text{..... (3)}$$

$$Energy\ intensiveness = \frac{Energy\ input\ (Mjha^{-1})}{Cost\ of\ production\ (YTLha^{-1})} \quad \text{..... (4)}$$

$$Net\ energy\ yield = Energy\ output\ (Mjha^{-1}) - Energy\ input(Mjha^{-1} \quad \text{.....(5)}$$

The ratio of energy input to input shows the efficiency of energy input as well as the marginal increase in output due to the unit increase in energy input. Singh et al. (2007) [35]. The ratio is higher at the lowest energy input and lower at the highest energy input, indicating that the reduced rate of return applied to energy input is low. It is in no way an indicator of the economic efficiency of agriculture. Rathke and Diepenbrock, (2006) [32] it is therefore not surprising that we find high-yield agricultural chains operating with very low energy efficiency. Energy inputs are examined as direct and indirect, renewable and non-renewable, and commercial and non-commercial.

## RESULTS AND DISCUSSIONS

### Socio-economic characteristics of the radish farms

Table 2 shows us the average household size of the farm family in the research was almost 5 people. The average age of farmers was 51 years old. Similarly, to those obtained by Miassi and Akdemir (2022) [19] that the average age of producers is 47 years old. Most farmers have experienced an average in agriculture of 27 years. Our results demonstrated that 16.8% of the farmers in the sample are primary or lower school graduates, 63.1% are middle or high school graduates, and 20.1% are university graduates.

Table 2. Socio-economic characteristics of the radish farms

| Variables | | N | % | Average |
|---|---|---|---|---|
| Age | 20-40 | 31 | 20.8 | 35.39 |
| | 41-60 | 89 | 59.7 | 51.29 |
| | More than 60 | 29 | 19.5 | 66.24 |
| Experience (years) | 1-15 | 30 | 20.1 | 11.73 |
| | 16-35 | 77 | 51.7 | 26.99 |
| | More than 35 | 42 | 28.2 | 44.55 |
| Household size | 1-3 | 20 | 13.4 | 2.35 |
| | 4-6 | 106 | 71.1 | 4.87 |
| | More than 6 | 23 | 15.4 | 9.48 |
| Education | Primary school or lower | 25 | 16.8 | - |
| | Middle school-high school | 94 | 63.1 | - |
| | University | 30 | 20.1 | - |
| Non-farm income | Yes | 75 | 50.3 | - |
| | No | 74 | 49.7 | - |
| Tractor presence | Yes | 134 | 89.9 | - |
| | No | 15 | 10.1 | - |
| Owned land (da) | 1-50 da | 33 | 27.7 | - |
| | 51-199 da | 51 | 42.9 | - |
| | More than 200 da | 35 | 29.4 | - |
| Multiple Shared Land (da) | 10-30 da | 5 | 25 | - |
| | 31-199 da | 9 | 45 | - |
| | More than 200 da | 6 | 30 | - |
| Rental Land (da) | 0-75 da | 17 | 22.7 | - |
| | 76-330 da | 40 | 53.3 | - |
| | 331-3,000 | 18 | 24 | - |

Source: Survey, 2019.

This result is not similar to Adisu (2020) [1], according to which the educational status of the respondents revealed that around 53.5% were unable to read and write. The majority of farmers own tractors 89.90%. Owning a tractor reduces the need for external labor (Kormawa et al. 2019) [15]. A tractor is much more cost-effective when deployed over a large area and also makes it easier to carry out activities and reduces the need for outside labor. Owned land (da), Multiple Shared Land (da), and Rental Land (da) in the study households were the most dominant with 42.9; 45 and 53.3% respectively.

The result showed that the total energy was calculated as 2,946.57 MJ $da^{-1}$ used for radish production (Table 3). Deep plowing had the highest energy use share followed by irrigation, first watering after transplanting, Second plowing, Sowing seeds, Pan, Spraying, Fertilization-Base and top, Harvest and Packaging energy inputs as 591.42MJ $da^{-1}$, 584.74MJ $da^{-1}$, 356.19MJ $da^{-1}$, 234.05MJ $da^{-1}$, 180.72MJ $da^{-1}$, 121.82MJ $da^{-1}$, 119.33MJ $da^{-1}$ and 1.147MJ $da^{-1}$ of total energy use, respectively. The energy consumption rates, energy efficiency, specific energy, and net energy of radish production are calculated in Table 3. The results revealed that the energy ratio was 1.62. Similarly, the energy ratio (only apple fruit) was 1.51 for apple production in Turkey by Akdemir et al. (2012) [3] and around 1.1 in high-density apple farms in Western US by Reganold et al. (2001) [33] and 1.0 considering only fruit and 2.37 considering fruit and pruning wood as outputs (Strapatsa et al. 2006) [37]. It has not collaborated with the results of Mousavi-avval et al. (2011) and Mousavi-avval et al. (2011a) [22, 21] cultivate soybean (2.29) and canola (3.02) crops for energy ratio. Also, Rafiee et al. (2010) [31] and Ozkan et al. (2005) [25] calculated this value of 2.86 and 5.10 for apples and grapefruits respectively. In our study, energy productivity was 0.62, and energy intensiveness was 2.28 $MJTL^{-1}$. Similarly, Akdemir et al. (2012) [3] stated that the energy efficiency is 0.63 and the energy density is 3.31 $MJTL^{-1}$. Strapatsa et al. (2006) [37] used values for energy productivity of 0.42 kg $MJ^{-1}$ and energy intensity of 2.5. Also, Blanke and Burdick (2005) [4] used values for energy intensity of 2.87 for European and 2.24 for New Zealand's apple production (due to larger yields), but, for flesh fruits, values of 1.2- 2 were reported in Italy (Pellizzi,1992) [27].

In addition, according to research results, the net energy yield was 1,853.43$MJda^{-1}$ and the specific energy was 1.47 MJ $kg^{-1}$. This finding is similar to Akdemir et al. (2012) [3] that the specific energy was 1.59 $MJkg^{-1}$.

Table 3. The energy consumption and Energy input-output relationship for radish

| **Input** | **Total energy equivalent ($MJda^{-1}$)** | **Percentage of total energy input ($MJda^{-1}$) (%)** |
|---|---|---|
| Deep plowing | 636.68 | 21.60 |
| Second Plowing | 356.19 | 12.08 |
| Sowing seeds | 234.05 | 7.94 |
| Pan | 180.72 | 6.10 |
| First watering after transplanting | 584.74 | 19.84 |
| Fertilization-Base | 119.33 | 4.14 |
| Fertilization-Top | 119.33 | 4.04 |
| Irrigation | 591.42 | 20.07 |
| Spraying | 121.82 | 4.13 |
| Harvest | 1.14 | 0.03 |
| Packaging | 1.14 | 0.03 |
| Total energy input (MJ/da) | 2,946.57 | 100.00 |
| Yield (kg/da) | 4,800.00 | – |
| Energy output-input ratio | 1.62 | – |
| Energy productivity($kgMJ^{-1}$) | 0.62 | – |
| Specific energy($MJkg^{-1}$) | 1.47 | – |
| Energy intensiveness ($MJTL^{-1}$) | 2.28 | – |
| Net energy($MJda^{-1}$) | 1,853.43 | – |

Source: Result of survey, 2019.

By increasing the yield of radish production and/or decreasing the energy consumption, especially deep plowing energy, radish production in the research region will be efficient. Estimation of energy input in different modes of energy sources. The sustainability of the energy used in agriculture has dimensions such as social, economic, and ecological as well as non-renewable energy. Direct, indirect, renewable, and non-

renewable energy inputs are shown in Table 4. The total energy used contribution of non-renewable energy 41.84% is higher in the radish than in the production of renewable energy 8.17%. The results show that radish production depends on non-renewable energy. Various researchers have figured out greater use of non-renewable energy sources than renewable energy in agricultural area energy consumption (Esengun et al. 2007, Ozkan et al. 2007, Pishgar-Komleh et al., 2012, Yilmaz et al. 2005) [7, 26, 30, 43]. 33.81% more indirect energy input than 16.18% direct energy. This finding is consistent with Pishgar-Komleh et al. (2012) [37] that direct (43%) and indirect (57%) energy contribute to energy intake. In addition, has not collaborated with the results concluded by Kızılaslan, (2009) and Özkan et al. (2004)[14, 24] that direct and indirect energies in agricultural production have almost equal shares. Pellizzi (1992) [27] found that 45-60% of total energy in corn production was in direct form while the contribution of indirect energy was 40-55%.

Table 4. Energy consumption under different energy sources for radish production

| **Energy forms** | **MJda$^{-1}$** | **% of total energy input** | **Inputs** |
|---|---|---|---|
| Direct energy | 1,404.90 | 16.18 | Human, diesel, electricity, canal |
| Indirect energy | 2,935.20 | 33.81 | Seeds, fertilizers, chemicals, machinery |
| Renewable energy | 708.16 | 8.17 | Human, seeds, canal |
| Non-renewable energy | 3,631.94 | 41.84 | diesel, electricity, chemicals, fertilizers, machinery |
| **Total** | 8,680.20 | 100.00 | |

Source: Result of survey, 2019

Table 5 revealed the unit cost of production per decare (da) for radish production of which labor cost, fuel cost (traction), and material used with 70.75; 14.41 and 14.84% respectively.

Table 5. Production costs of the product of radish

| **Unit cost** | **Labor** | **Fuel** | **Material Used** | **Total** |
|---|---|---|---|---|
| % | 70.75 | 14.41 | 14.84 | 100 |

Source: Survey, 2019.

In our study, the profit rate is 87.82% and we also observe that the production cost and sales price ($/ ton) of radish are obtained at 21.69 and 40.21 respectively as presented in Table 6. The total sales and total cost in radish production are calculated as 8,266,627.16 and 4,401,252.81 respectively. In addition, we obtained 3,865,374.35 of sales-cost and a profit rate of 87.82% are given in Table 7.

Table 6. Production cost of radish

| **Production Cost ($/ton)** | **Sales Price ($/ ton)** | **Profit rate (%)** |
|---|---|---|
| 21.69 | 40.21 | 87.82 |

Source: Survey, 2019.

Table 7. Product of radish sale and cost

| **Total Sales ($)** | **Total Cost ($)** | **Sales - Cost** | **Profit rate (%)** |
|---|---|---|---|
| 887.82266627.16 | 4,401,252.81 | 3,865,374.35 | 87.82 |

*1 US $=18.90 TL (March 2023).
Source: Survey, 2019.

## CONCLUSIONS

In this study, energy use patterns in radish production in Osmaniye Province in Turkey were investigated. The total energy used in radish production was 2,946.57 MJda$^{-1}$. While

the energy input from the plowing had the largest share in the total energy input, it was followed by irrigation and the first irrigation after planting 16.18% of the energy input used in radish production is direct while 33.81% is indirect energy input. In addition, the share of renewable was (8.17%) and non-renewable (41.84%) energy inputs. The reason for the high consumption of deep plowing is the temporary wear and tear of machinery, especially tractors. The production cost and selling price ( $ / ton) of radish are obtained at 21.69 and 40.21 respectively. We find that the profit rate of agricultural income was 87.82% while that of energy was 61.38%. By focusing on price, the price of inputs may change but the energy remains constant. The equipment that the cost is not high that can be useful for the production of radish in the study area will be effective.

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# SOCIO-ECONOMIC IMPACT OF THE EARTHQUAKES OF FEBRUARY 2023 ON AGRICULTURAL PRODUCTION OF TÜRKIYE

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***Abstract***

*In order to determine and analyse the socioeconomic impacts on agricultural production of the 2 earthquakes with magnitudes of 7.4 and 7.3 that occurred in Turkey on February 6, 2023, a research survey was conducted and the data obtained from the surveys were evaluated. The survey was carried out in 15 villages in total, in 3 villages selected to represent each of the 5 districts where the earthquake was intensely felt. According to the results, besides the loss of life and property in rural areas, the earthquake had a significant impact on production factors, especially the stock of warehouses, tractor capital, manpower, and caused disruptions in supply chains and delays in agricultural activities.*

***Key words*****:** *earthquake, socio-economic impact, agricultural production, Türkiye*

## INTRODUCTION

Natural disasters (earthquakes, volcanic eruptions, tsunamis, fires, floods, droughts, etc.) are phenomena that occur naturally, often cyclically, but sometimes abruptly and brutally. These phenomena, which are entirely normal and historically justifiable, occur either absolutely and naturally (as in the case of earthquakes, volcanoes, and glaciations), or as a result of phenomena directly or indirectly caused by human practices and uses (landslides, floods, forest fires, desertification, prolonged droughts, snow melting, etc.).

These disasters have always existed, long before the presence of humans and other living beings. They have marked the different geological and historical eras of the planet Earth. Prehistory and geological studies have shown perfectly the destructive impact of this type of disaster, such as the complete disappearance of prehistoric animal species (dinosaurs, insects, microorganisms), as well as significant transformations in the geographical configurations of territories and continents (for example, these phenomena often accelerate the drift of continents). This is therefore not something strange or exceptional. However, these phenomena are destructive and cause significant degradation, numerous injuries, incomparable tragedies, and indelible consequences for humans, animals, and lands capes [10].

We are interested in these phenomena mainly for their effects on the way of life and economic conditions of many categories of populations, including farmers and rural populations (their habitats, material goods, and agricultural production systems).

In this research, we focus on earthquakes and their massive destruction of territories, goods, and populations, which are becoming more

and more recurrent and destructive, causing serious and indelible effects.

Earthquakes (like volcanic eruptions) have serious and harmful effects on everything that is on and lives on Earth (and even in the seas and oceans). Large earthquakes (on the order of 6.5° to 7.5° up to 8° on the Richter scale) are violent. The earth is fissured, and everything on it is disrupted and destroyed. In this type of natural disaster, it is primarily cities and large and medium-sized urban areas that are most affected, along with their buildings, basic infrastructure (roads, bridges, dams, railways, ports and airports, etc.), as well as any human and animal populations[3, 8, 9]. These urban areas, often built or constructed without taking into account seismic rules and norms, are destabilized in their foundations and structures. Buildings and structures break, resulting in tragedies and significant human losses. Thus, from an economic and human standpoint, it is mainly urban areas and populated and built-up spaces that suffer the most destruction and losses: losses primarily in human lives, deep physical and psychological disabilities and injuries, incalculable economic losses, not to mention the complete disorganization of all territorial development and urban planning. Therefore, even if the effects of these phenomena appear as serious and costly effects primarily on cities and their populations, they also increasingly appear as serious effects on both the gravity of the economic situation of peasants and farmers and on the significant disruption of all rural environments, their structures and foundations [11]. Even if there are no significant human losses and serious injuries compared to what occurs in cities, many farmers and peasant families, and even agri-food business leaders, record losses in both human and physical and psychological disabilities [18]. This serious situation also creates significant disruptions in family structures and sometimes the breakdown of social structures due to forced rural exodus and sometimes the fragmentation of family units. One must not forget the negative effects on production, conditioning, transformation, marketing, and distribution conditions. This is a field of investigation and research work of a university and expertise nature, in the medium and long term that should be urgently initiated.

Despite the importance of the subject, few studies on the subject exist in the world and even rarer in Turkey [1, 9]. This is what motivates this research on the impact of earthquakes on agricultural production.

## MATERIALS AND METHODS

This study was designed to investigate the impact of earthquakes on agriculture in the affected areas of Türkiye. The study was conducted using both quantitative and qualitative research methods. The quantitative data was collected through reports and TUIK database, while qualitative data was collected through in-depth interviews with farmers and breeders. The group interviews were conducted after the earthquakes to capture the impact of the disaster on agriculture. The choice of that method is justified by the importance given to the opinion of the participants [4, 14].

In this study, we used data from the Turkish Statistical Institute (TurkStat) to investigate the importance of the affected areas of cultivated grains, vegetables, fruits, and ornamental plants in the earthquake regions of Turkey. The data was obtained from the 2022 Agricultural Census conducted by TurkStat, which provided information on the agricultural land and livestock in each of the 81 provinces of Turkey.

We focused our analysis on the 11 provinces that are within the earthquake zone, which covers 40 million hectares of agricultural land. For each province, we obtained data on the total area of cultivated grains, vegetables, fruits, and ornamental plants, as well as the percentage of each crop within the province and the overall percentage for the earthquake zone and Turkey as a whole.

To assess the importance of the earthquake zone in crop production, we calculated the percentage of each crop that was cultivated within the zone and compared it to the percentage of the total agricultural land in the zone. We also identified the top producers of each crop within the zone and calculated their

percentage contribution to the total production.

In addition to crop production, we also analysed the livestock in the earthquake zone. We obtained data on the number of beehives, cattle, and sheep/goats within each province and calculated the percentage of each livestock type within the zone and Turkey as a whole.

All data were analysed using Microsoft Excel and presented in tables to facilitate interpretation.

## RESULTS AND DISCUSSIONS

### Importance of the affected areas

According to a report of the FAO, the earthquake in Türkiye severely impacted 11 key agricultural provinces, affecting over 15 million people and more than 20% of the country's food production; the affected regions account for almost 15% of agricultural GDP and contributes to nearly 20% of Türkiye's agrifood exports.

Initial assessments estimate $1.3 billion in damage and $5.1 billion in losses to the agriculture sector, with disrupted supply chains and financial challenges exacerbating the struggle of rural families to access and afford productive inputs [5].

Turkey's earthquake zone covers 40 million hectares of agricultural land, which accounts for 16.9% of the country's total agricultural area.

Within this zone, vegetable production covers 16.2%, fruit production covers 26.0%, and ornamental plant cultivation covers 3.3% of the total agricultural area.

Table 1. Cultivated Areas of Grains, Vegetables, Fruits and Ornamental Plants in the Earthquake Regions

| | **Total Area (100 ha)** | **Türkiye %** | **Cereal & Other Plant Product Areas** | **Türkiye %** | **Vegetable Areas** | **Türkiye %** | **Fruits** | **Türkiye %** | **Ornamental Plant Areas** | **Türkiye %** |
|---|---|---|---|---|---|---|---|---|---|---|
| Adana | 5,046 | 2.0 | 3,687 | 2.2 | 259 | 3.6 | 1,038 | 2.8 | 1.36 | 2.4 |
| Hatay | 2,380 | 0.9 | 1,105 | 0.7 | 210 | 2.9 | 1,012 | 2.8 | 0.23 | 0.4 |
| Kahramanmaraş | 3,557 | 1.4 | 2,550 | 1.5 | 68 | 0.9 | 658 | 1.8 | 0.02 | 0.0 |
| Osmaniye | 1,262 | 0.5 | 966 | 0.6 | 68 | 0.9 | 220 | 0.6 | 0.04 | 0.1 |
| Malatya | 2,724 | 1.1 | 1,023 | 0.6 | 42 | 0.6 | 988 | 2.7 | 0.05 | 0.1 |
| Elazığ | 7,826 | 3.0 | 1,125 | 0.7 | 75 | 1.0 | 301 | 0.8 | 0.15 | 0.3 |
| Gaziantep | 3,469 | 1.3 | 1,127 | 0.7 | 136 | 1.9 | 2,190 | 6.0 | 0.00 | 0.0 |
| Adıyaman | 2,262 | 0.9 | 1,598 | 1.0 | 50 | 0.7 | 595 | 1.6 | 0.00 | 0.0 |
| Kilis | 1,025 | 0.4 | 384 | 0.2 | 51 | 0.7 | 546 | 1.5 | 0.00 | 0.0 |
| Şanlıurfa | 11,040 | 4.3 | 7,816 | 4.7 | 104 | 1.4 | 1,802 | 4.9 | 0.03 | 0.0 |
| Diyarbakır | 5,754 | 2.2 | 5,346 | 3.2 | 107 | 1.5 | 213 | 0.6 | 0.00 | 0.0 |
| **Total of the 11 provinces** | **46,345** | **17.9** | **26,727** | **16.2** | **1,170** | **16.3** | **9,563** | **26.0** | **1.87** | **3.3** |
| The other provinces | 212,106 | 82.1 | 138,139 | 83.8 | 6,006 | 83.7 | 27,191 | 74.0 | 55 | 96.7 |
| **Türkiye** | **258,451** | 100.0 | **164,866** | 100.0 | **7,176** | 100.0 | **36,754** | 100.0 | **57** | 100.0 |

Source: [16](https://biruni.tuik.gov.tr/medas/?locale=tr).

The region also houses 1.35 million tractors, which represents 12.8% of Turkey's 15.1 million tractor stock. In terms of crop production, the largest agricultural area is Elazig with 16.9%, followed by Sanliurfa with 23.8% and Diyarbakir with 12.4%. For grain cultivation, Adana and Sanliurfa are the top producers with 29.2% and 16.2%, respectively. In terms of vegetable cultivation, Adana ranks first with 22.1%, followed by Hatay with 17.9% and Gaziantep with 11.6%. The earthquake zone plays a significant role in vegetable production in Turkey.

When it comes to beekeeping, Diyarbakir is the top producer with 10.1% of the region's beehive stock, followed by Sanliurfa with 10.8%, Hatay and Malatya with 7.7%. In terms of animal husbandry, Diyarbakir ranks first with 25.9% of cattle, followed by Sanliurfa with 14.6% and Adana with 11.53%. For small ruminants, Diyarbakir and Sanliurfa rank first and second with 1.1% and

23.2%, respectively, followed by Adana and Kahramanmaras.

Table 2. Livestock in the Earthquake Zone

| | Beehives | % Within the 11 provinces | Türkiye % | Cattle | % Within the 11 provinces | Türkiye % | Sheep / Goats | % Within the 11 provinces | Türkiye % |
|---|---|---|---|---|---|---|---|---|---|
| Adana | 494,432 | 34.1 | 5.5 | 266,601 | 11.3 | 1.6 | 1,116,289 | 10.7 | 2.0 |
| Adıyaman | 73,647 | 5.1 | 0.8 | 111,470 | 4.7 | 0.7 | 368,544 | 3.5 | 0.7 |
| Diyarbakır | 146,857 | 10.1 | 1.6 | 608,214 | 25.9 | 3.6 | 2,209,368 | 21.1 | 3.9 |
| Elazığ | 118,619 | 8.2 | 1.3 | 187,326 | 8.0 | 1.1 | 1,089,120 | 10.4 | 1.9 |
| Gaziantep | 28,123 | 1.9 | 0.3 | 200,050 | 8.5 | 1.2 | 698,317 | 6.7 | 1.2 |
| Hatay | 111,959 | 7.7 | 1.2 | 149,206 | 6.3 | 0.9 | 538,745 | 5.2 | 1.0 |
| Kahramanmaraş | 122,747 | 8.5 | 1.4 | 242,239 | 10.3 | 1.4 | 1,170,072 | 11.2 | 2.1 |
| Kilis | 8,179 | 0.6 | 0.1 | 12,785 | 0.5 | 0.1 | 222,698 | 2.1 | 0.4 |
| Malatya | 111,360 | 7.7 | 1.2 | 174,986 | 7.4 | 1.0 | 367,606 | 3.5 | 0.7 |
| Osmaniye | 78,677 | 5.4 | 0.9 | 68,292 | 2.9 | 0.4 | 249,684 | 2.4 | 0.4 |
| Şanlıurfa | 157,201 | 10.8 | 1.7 | 331,181 | 14.1 | 2.0 | 2428459 | 23.2 | 4.3 |
| **Total of the 11 provinces** | **1,451,801** | **100.0** | **16.2** | **2352350** | **100.0** | **14.0** | **10,458,902** | **100.0** | **18.6** |
| The other provinces | 7,532,875 | | 83.8 | 14,499,606 | | 86.0 | 45,806,848 | | 81.4 |
| **Türkiye** | **8,984,676** | | **100.0** | **16,851,956** | | **100.0** | **56,265,750** | | **100.0** |

Source: [16] (https://biruni.tuik.gov.tr/medas/?locale=tr).

Table 3. Planting Areas of Priority Crops in Earthquake Zone (100 hectares)

| | Wheat | % Within the 11 provinces | Türkiye % | Corn | % Within the 11 provinces | Türkiye % | Cotton | % Within the 11 provinces | Türkiye % |
|---|---|---|---|---|---|---|---|---|---|
| Adana | 1,420 | 12.1 | 2.1 | 867 | 27.0 | 9.5 | 303 | 7.1 | 5.3 |
| Adıyaman | 559 | 4.8 | 0.8 | 29 | 0.9 | 0.3 | 82 | 1.9 | 1.4 |
| Diyarbakır | 2,766 | 23.7 | 4.2 | 180 | 5.6 | 2.0 | 830 | 19.6 | 14.5 |
| Elazığ | 445 | 3.8 | 0.7 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Gaziantep | 626 | 5.4 | 0.9 | 64 | 2.0 | 0.7 | 60 | 1.4 | 1.0 |
| Hatay | 491 | 4.2 | 0.7 | 173 | 5.4 | 1.9 | 460 | 10.8 | 8.0 |
| Kahramanmaraş | 1,403 | 12.0 | 2.1 | 280 | 8.7 | 3.1 | 71 | 1.7 | 1.2 |
| Kilis | 222 | 1.9 | 0.3 | 6 | 0.2 | 0.1 | 4 | 0.1 | 0.1 |
| Malatya | 455 | 3.9 | 0.7 | 2 | 0.1 | 0.0 | 0.025 | 0.0 | 0.0 |
| Osmaniye | 383 | 3.3 | 0.6 | 393 | 12.3 | 4.3 | 5 | 0.1 | 0.1 |
| Şanlıurfa | 2,922 | 25.0 | 4.4 | 1,212 | 37.8 | 13.3 | 2,425 | 57.2 | 42.3 |
| **Total of the 11 provinces** | **11,692** | **100.0** | **17.6** | **3,206** | **100.0** | **35.2** | **4,240** | **100.0** | **74.0** |
| The other provinces | 54,596 | | 82.4 | 5,913 | | 64.8 | 1,492 | | 26.0 |
| **Türkiye** | **66,288** | | **100.0** | **9,119** | | **100.0** | **5,732** | | **100.0** |

Source: [16] (https://biruni.tuik.gov.tr/medas/?locale=tr).

Regarding wheat cultivation, Sanliurfa leads with 25.0%, followed by Diyarbakir with 23.7%, Adana with 12.1%, and Kahramanmaras with 12.0%.

For corn production, Sanliurfa is again the top producer with 37.8%, followed by Adana with 27.0% and Sanliurfa with 12.3%.

In cotton production, Sanliurfa leads with 57.2%, followed by Diyarbakir with 19.6% and Hatay with 10.3%. In total, the earthquake zone accounts for 74% of Turkey's corn production, 35% of its wheat production, and 17.6% of its cotton production.

The region's yield is also higher than the national average, with wheat yield 10% higher and corn yield over 110% higher than the national average, while cotton yield is similar to the national average.

**Impact assessment**

After the 7.8 and 7.5 magnitude earthquakes that occurred nine hours apart on February 6, 2023, based in Kahramanmaraş, many sectors in Turkey's region, especially the agricultural sector, were affected. Investigations were conducted in the districts of Ince and Hüyüklü in Afşin, and Beyoğlu district in Türkoğlu, as well as Samankaya and Değirmenyolu district in Defne, and Olucak and Emirler districts in Nurdağı.

Since the first product in agricultural production, such as wheat and barley, is planted in the examined districts and

neighbourhoods, no disruption was detected in the cultivation of the fields. Due to the low number of cases resulting in death in rural horticultural activities, no disruptions were identified. The biggest disruption in agricultural activities was found to be in the supply chain of pesticides and fertilizers. Due to the collapse of the buildings where the pharmacies and fertilizer stores were located in the city centres, problems were identified in the supply of drugs and fertilizers in all earthquake zones. Although they tried to be supplied from neighbouring cities, the earthquake affecting 11 adjacent provinces was the biggest obstacle in the supply stage. Although some farmers from Mersin, Konya, and Adana tried to meet their needs through their relatives, there was no solution for large-scale production. It is estimated that there will be a loss of nearly 30% in wheat due to the arrival of weed control in wheat fields, especially in all earthquake zones. This consequence has also been faced in similar cases in Japan impacting the country GDP at 0.35% at least [15]. Studies proved that the economically less developed provinces are more susceptible to larger losses due to future disasters and that severe value-added losses are due to indirect effects through supply chains [7].

When asked about the situation of farmers engaged in vegetable farming, especially in the districts of Defne, Hatay, they reported that they had lost half of their products due to the supply problem of fungal drugs [7, 12] Similarly, it was predicted that there would be losses in product quality and yield in plant feeding products due to supply problems. In a pumpkin field examined, it was seen that there were calibration and shape problems in the products due to fungal diseases and the lack of plant feeding products. Similar problems were observed in cucumber, tomato, and eggplant fields in the same region.

The biggest disruption in agricultural activities occurred in greenhouse production. 40% of the greenhouses planted in the region became a place of accommodation for both those who migrated from the city to the countryside and producers who could not enter their homes in rural areas after the earthquake. The conversion of the products inside the greenhouse to a place of accommodation led to a 40% contraction in greenhouse production.

There is sugar beet production in the region due to the sugar factory located in Kahramanmaraş Elbistan. Since there is no obstacle to production in the factory, sugar beet producers did not suffer damage in the earthquake, and the estimated planting time is in March-April, this industry continues without any problems.

In the interviews, it was observed that rural areas were seen as a safe zone, and there was a significant migration from cities to rural areas due to the earthquake. It was observed that the people did not migrate from rural areas, which were usually used as vegetable gardens, to cities, but there were significant migrations from cities to rural areas. Indeed, disasters have proven a migration flux to happen in response of population running from the affected areas [2, 13].

It has been observed that small agricultural lands that used to be used for irrigated agriculture and contributed to the rural family budget cannot be used due to the conversion of these lands into accommodation areas. This is because tents are set up on these lands. Producers have stated that this situation will cause a contraction of around 10% in household income in rural areas. However, there is no problem for the producers to continue production because it is believed that rural areas are safe and it is easier to access food and clean water than in cities. Agricultural incomes are also seen as a guaranteed income. Serious deformations due to earthquakes have not been detected in agricultural areas. It has been observed that the soil has risen and the trees have been uprooted in certain areas. It has been observed that there is earthquake-related damage at a level of 3% in gardens established on fault lines.

With the help of the Ministry of Agriculture and Forestry's support for feed and veterinary services, disruptions in the livestock sector have been addressed. Livestock that were housed in destroyed barns were transferred to safe barns, preventing losses. Although there

were disruptions in feed supply due to the presence of feed dealers in city centres and their exposure to the same damage as agricultural dealers, the Ministry of Agriculture and Forestry coordinated a quick supply from neighbouring provinces as there were live animals that needed daily feeding. The biggest loss in the livestock sector was due to the collapsed barns, which resulted in a 2% loss of total cattle population. Power outages caused disruptions in the milking systems, which seriously affected animal welfare. Small family businesses tried to solve this problem by manual milking. Large-scale farms generated electricity with generators, but there were also disruptions due to fuel shortages. The problem was fully felt in medium-sized businesses. In addition to the risk of losses due to logistics disruptions in milk production, there were also 50% yield losses due to mammary disorders in cows that were not milked. At the same time, the earthquake disaster burdened producers with new cost items such as veterinary and medication expenses.

There was no mechanical damage in poultry houses for broiler chicken production, but there was a 30% loss of chickens in the houses due to earthquake stress. Mass deaths occurred as the chickens tended to gather in one direction during the earthquake. Meeting the feeding needs of broiler and egg-laying chickens is an instant need in poultry production. Although the collapse of feed warehouses and disruptions in feed transportation caused a 20% loss of productivity, officials tried to address the disruptions quickly.

Beekeeping activities are carried out in two ways: migratory beekeeping and stationary beekeeping. During migratory beekeeping, beekeepers stay in huts at the bee yard, so there is no interruption in this activity. Especially during the wintering period, there is no urgency for maintenance in the hives, so there is no interruption in migratory beekeeping activities. Stationary beekeeping represents 10% of the total beehives in the region. The owners of the hives mostly reside in city centres or rural neighbourhoods. Stationary hives have been seen in place, but information about their owners could not be obtained at that time. This situation will cause damage to beekeeping activities at worst by 10%. Honey, which is a food that has an infinite shelf life when stored properly, has maintained its value due to being the healthiest energy source in natural disasters.

When the tractor presence in rural areas is examined, although the tractors and agricultural equipment and tools parked in open areas generally appear to have not been damaged, more technologically advanced planting equipment with computer support has been kept in enclosed spaces and has been trapped in the debris. During the interviews, it was determined that 30% of the rural neighbourhoods examined were completely destroyed, and 25% of them were damaged compared to the total destruction and clean-up rate. It has been observed that 5% of the total tractor presence in rural areas is trapped under the rubble.

The supports provided to earthquake-stricken producers in terms of agricultural support can be listed as follows:

-Direct support for hay and feed was provided to producers engaged in livestock farming.

-Support payments of 500 TL per large animal and 50 TL per small animal were made.

-Seed grants were provided from the Ministry of Agriculture and Forestry budget to be used for corn, sunflower, soybean, dry bean, and chickpea planting in earthquake-prone areas.

-Support payments for animal feed and diesel fertilizer were paid earlier than the scheduled payment dates to encourage production.

-Animals of the livestock businesses whose barns were destroyed were moved to safe areas to continue production.

-Generator support was provided until electricity was provided to the regions for production to continue.

We can list the priority problems seen in the discussions with earthquake zone producers as follows:

-It was observed that the biggest problem of producers is access to plant protection and plant nutrition products.

-Due to the use of greenhouses as tents for accommodation, there was a contraction in production areas.

In summary, there is a significant migration intensity from cities to rural areas rather than from rural areas to cities. It is predicted that this reverse migration will cause a contraction in agricultural areas. Container-style structures built on agricultural lands are also predicted to cause similar problems of unplanned urbanization in rural areas. As the number of fatalities in rural areas was lower than in city centres, there was no loss of workforce, but it was observed that they needed help in terms of the psychological effects of the losses of their relatives or friends in city centres. Public institutions and organizations are working rapidly to repair the material damages in the region related to the local people. It was observed that producers who need help psychologically also need spiritual support. It was seen that the new people who migrated from cities to rural areas had a need for education if they wanted to start from scratch in agriculture more than the producers who gave up production [6,17].

## CONCLUSIONS

The data presented shows the significant impact of the earthquake zone on agriculture in Turkey. The affected areas comprise 16.9% of the country's agricultural land, and within this zone, the production of vegetables, fruits, and ornamental plants are vital with 16.2%, 26.0%, and 3.3% of the total agricultural area, respectively. The regions are also responsible for producing a substantial amount of grains and vegetables, with Adana and Sanliurfa being the top producers. The earthquake zone also plays a crucial role in the livestock sector in Turkey, with the highest number of sheep and goats found in Diyarbakir, and the highest number of beehives in Adana. Thus, the affected areas have a significant impact on the country's agricultural production and should be given special attention in terms of disaster management and preparedness. If in cities the scale of degradation and the magnitude of physical and material losses prompt States to intervene to help compensate, relocate people, and rehabilitate some of the destroyed or degraded infrastructure, the situation is more complex in rural areas. Beyond addressing the consequences of human losses, injuries, and cases of relocation of rural populations, there is above all a problem of rehabilitating and reviving agricultural activities, of which a large part has been completely wiped out.

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# DIGITALIZATION, FINANCIAL INSOLVENCY AND BANKRUPTCY RISK FORECASTING OF BULGARIAN AGRICULTURAL ENTERPRISES

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***Abstract***

*This paper aims to study the impact of agricultural enterprises' digitization and the performance and bankruptcy risk. Analyzing financial insolvency and predicting bankruptcy risk is a constant focus of research. Company managers and their creditors, auditors, counterparties, etc., are very interested in this issue. Many economists are constantly looking for adequate models and methods by which to establish the financial health of companies with the most significant degree of precision. This paper answers whether some of the most commonly used bankruptcy prediction models also apply in the agricultural sector. For this purpose, a study was made of the annual statistical reports of medium and large Bulgarian agricultural enterprises operating in this sector for five years. Next, the paper's authors also look for evidence that agricultural enterprises with a higher level of digitalization and application of information and communication technologies face a lower risk of bankruptcy and better performance, applying the fixed effect and probit models. The econometric analysis clearly shows a statistically significant relationship between the risk of bankruptcy and the productivity of agricultural enterprises, measured by ROA. Applying the probit model reveals a higher probability of bankruptcy for firms with lower productivity and higher leverage.*

***Key words*****:** *livestock sector, insolvency, z-score models, digitalization, fixed effect model, probit model*

## INTRODUCTION

The unpredictable character of future activity is a serious issue, faced by Bulgarian managers at present.

It affects all economic branches, without exception, which justifies the increased attention it has received. Economic research constantly explores methods for predicting the risk of eventual bankruptcy and its prevention (Agarvaletal., 2007), (Lukason 2014), (Rijanto, 2022) [1, 11, 16].

Insolvency is a term, whose legal definition states that "a merchant is declared bankrupt, either in case of insolvency, or over-indebtedness." (Commercial Law) [7].

In colloquial terms, more commonly the state of business venture failure and the inability to pay debts is called *bankruptcy*.

Numerous institutions show an interest in the dynamics and trends of insolvency and annually publish their reports on its level (COFACE, Eurostat, etc.) [6].

According to prognostic data of COFACE, Bulgaria for 2022 the number of insolvent companies amounts to 532, which represents a growth of 3.10% against 2021.

The total share of companies on a state level, which have announced insolvency, equals to 0.13%, whereas in some branches, the percentage reaches a level of 0.6%. In the agricultural sector and particularly in livestock farming, the prognostic levels fluctuate at about 0.32%.

The present situation to a large extent is a result of the current economic crisis and the restrictions posed during the Covid-19 pandemic. Despite the measures taken by the government to remedy its consequences (tax advantages, deferral of payments of social and fiscal obligations in time, paid leave schemes, simplification of administrative procedures, etc. (COFACE, 2022) [6], the growing trend of insolvency of Bulgarian companies is worrisome. Therefore, precise bankruptcy risk forecasting methods continue to engage the

attention of businesses and their funding institutions.

The object of the study are large and medium-sized Bulgarian companies from the livestock sector, while its subject is:

(a)applicability evaluation of the Z-score models of insolvency risk assessment in the same sector;

(b)revealing the cause-and-effect relationship between the stage of digitalization and the risk of bankruptcy.

The aim of this study is to evaluate the possibility for using significant statistical models for the analysis of insolvency risk and to compare the obtained results through these models and other traditional financial coefficients used in the agricultural sector, and livestock, in particular.

On this basis, the most suitable model shall be indicated, as well as comprehensive and precise investigation of the financial state of the livestock farm.

The authors of this publication attempt to prove that companies which have a higher level of digitization and operate with ICT, face a reduced risk of insolvency, and have better performance. The empirical study attempts to analyze and evaluate the relationship between the costs of innovation activity and digitization and the performance of agricultural enterprises through the return on assets. Whether agricultural enterprises exposed to a higher risk of bankruptcy have poorer performance and lower productivity is sought. Also, do the costs of innovation activity and digitization affect the risk of default, i.e., is there a positive correlation between them?

## MATERIALS AND METHODS

One of the first models of insolvency risk analysis, encountered in economic research belongs to Prof. Edward Altman (Altman, 1968) [2]. Later, the same model has undergone amendments (Altman, 2000) [3], primarily in the part of coefficients before the variables and has become widely popular in the following variant:

$$\boldsymbol{Z = 1.2 * X1 + 1.4 * X2 \pm 3.3 * X3 \pm 0.6 * X4 + 0.999 * X5}$$

.....(1)

The X variables represent relations of different indicators from the financial reports of the studied enterprises.

For example, in Table 1, there are presented the indicators used by different authors for forecasting insolvency risk.

Table 1. Insolvency risk forecasting indicators

| X | Altman | Springate | Poznanski | Hadasik |
|---|---|---|---|---|
| X1 | WK/TA | WK/TA | NP/TA | CA/CL |
| X2 | RE/TA | EBIT/TA | (CA-I)/CL | (CA-I)/CL |
| X3 | EBIT/TA | EBT/CL | (E+NCL)/TA | TL/TA |
| X4 | MVE/TL | S/TA | NP/S | WK/TL |
| X5 | S/TA | - | - | R/S |
| X6 | - | - | - | **I/S** |
| | **Z<1.81** | **Z<0.862** | **FD<0** | **ZHA<0** |

Source: Own contribution.

where:

WK – Working Capital;
TA – Total Assets;
RE – Retained Earnings;
EBIT – Earnings Before Interest and Taxes;
MVE – Market Value Equity;
TL – Total Liabilities;
S – Sales;
EBT – Earnings Before Taxes
CL – Current Liabilities
NCL – Non-current Liabilities
CA – - CurrentAssets
NP – Net Profit
E – Equity
I–Inventories
R – Receivables

In 1978 Gordon Springate tests the Altman model and modifies it by using four, instead of five variables (Todorov, 2014) [17]:

$$\boldsymbol{Z = 1.03 * X1 + 3.07 * X2 \pm 0.66 * X3 \pm 0.4 * X4}$$

.....(2)

The previous two models have been developed on the basis of evidence from companies operating on the territory of, respectively, the USA and Canada. In view of the limitations of the volume of this publication, the study presents two more models, approved for companies in Eastern

Europe– the Poznanski Model and the Hadasik Model (Delev, 2015; Kiselinska, J., 2016).) [10, 13 ].

Both of them examine the probability of arising financial difficulties, as the former is four-factor, while the latter – six-factor.

***Poznanski Model***:

$$\boldsymbol{FD = 3.562 * X1 + 1.588 * X2 \pm 4.288 * X3 \pm 6.719 * X4 - 2.368}$$

..... (3)

***Hadasik Model***:

$$\mathrm{ZHA} = 2.36261 + 0.365425 * \mathrm{X1} - 0.765526 * \mathrm{X2} - 2.40435 * \mathrm{X3} + 1.59079 * \mathrm{X4} + 0.00230258 * \mathrm{X5} - 0.0127826 * \mathrm{X6}$$

.....(4)

The presented Table 1. *Insolvency Risk Forecasting Indicators* shows some of the muse coefficients, typical for traditional financial analysis, such as profitability based on sales, assets, liquidity, etc.

Table 2. Financial sustainability and solvency indicators

| № | Indicator | Formula | Threshold values |
|---|---|---|---|
| 1. | *Equity Ratio* | $ER = \frac{E}{TA}$ | *ER> 0.5* |
| 2. | *Equity to Debt Ratio* | $EDR = \frac{E}{TL}$ | *EDR>1* |
| 3 | *Debt Ratio* | $DR = \frac{TL}{TA}$ | *DR< 0.5* |
| 4 | *Working Capital to Current Assets Ratio* | $WCAR = \frac{WK}{CA}$ | *WCAR>0* |
| 5 | *Non-current Assets Financing Ratio* | $NCAFR = \frac{E + NCL}{NCA}$ | *NCAFR>1* |
| 6 | *Current Ratio* | $CR = \frac{CA}{CL}$ | *1.0 <CR<3.0* |

Source: Todorov (2014), Mihailovetal (2013), Kasarova, 2010) [17, 15, 12].

Therefore, the study explores in further detail the analysis of probability of bankruptcy risk through the use of the above mentioned 4 (four) models, with additional assessment of financial sustainability and solvency of the analyzed companies through key financial ratios (Todorov, 2014), (Mihailovetal.,2013), (Kasarova, 2010) [17, 15, 12] (Table 2).

As most reliable among the selected methods of analysis of the bankruptcy risk, will be deemed the method that involves the closest match with the analysis results through the financial sustainability and solvency indicators.

The fixed effect models are widely used in literature for the analysis and assessment of dependencies in panel data (Bell and, Jones, 2015) [4].

They allow us to consider the existence of specific characteristics of enterprises (unit-specific effects), which appear during the performance of the activity, yet are not included as variables in the model (non-observed heterogeneity). These models allow us to correlate the descriptive variables to individual characteristics (effects) of each enterprise, α_i. The individual effects, α_i are included in the model as a constant. Each enterprise (statistical unit in our study) has different individual (specific) characteristics, expressed in the equation:

$$y_{it} = \alpha_i + \mathrm{x'}_{it}\beta + u_{it} \text{.....(5)}$$

Variables of the model:

The dependent variable in the present study is the annual *return on assets* (ROA), measured as a ratio of the net profit to the total assets of the enterprise.

ROA is a widely used indicator for measuring company efficiency with respect to used assets.

For the purposes of econometric analysis, the ROA change is represented as a function of the following factors: income growth, bankruptcy risk, capital structure, and the subsector where the enterprise operates.

The variable that constitutes the greatest interest of this study is bankruptcy risk, which we present with the evaluation of the Altman's Z-score model. For the purposes of this analysis, we have used the obtained values for the indicator over a 5-year period.

Inviewofexaminingtheimpactonthecostsforsoftwareandotherintangibleassets, we introduce the variable *digit*, calculated as intangible assets divided by total assets. We think that the obtained coefficient is indicative for the

digitalization process in livestock firms, keeping in mind that the research and development costs tend to be sporadic, while the greatest part of the remaining ones is taken up by software expenses.

The choice of the other variables in the model is based on control variables that are widely used in economic literature.

We adopt the variable *sales growth*, measured as the growth rate of sales revenues, to trace the presence of a dependency between the percentile change of revenue and the results from business activity.

As an indicator of the differences in the capital structure of enterprises we use the variable *solvency*, calculated as a ratio of the total sum of liabilities and the own capital. The high debt level in capital structure is often viewed as preceding the shrinking of possibilities for external funding of enterprises and leading to a decrease in their profitability and investment and innovation activity. The expectations are that the high debt levels to have a negative effect on the processes of digital transformation.

We have observed the impact of the subsector, in which the enterprise operates. The firms in the sample are active in the following subsectors: dairy cattle, swine, poultry, and other animals (beekeeping).

The panel of data allows us to analyze and evaluate their change in two directions. The first one is at the level of the enterprise, so that we can trace the changes in returns within a 5-year period. Secondly, it is suitable to search for effects at the level of annual (aggregated) values among enterprises. In this study, we admit that livestock farms possess specific, individual characteristics, which also have an effect on their financial results.

For the purposes of this study, we have evaluated the following regression model with fixed effects:

$$ROA_{it} = \alpha_0 + \beta_1 Salesgrowth_{it} + \beta_2 Solvency_{it} + \beta_3 Bankruptcy_{it} + \beta_4 Subsector_{it} + \epsilon_{it} \quad \text{.....(6)}$$

In the following analysis we have attempted to examine the probability that enterprises may go bankrupt as a function of innovation and digital transformation costs through the application of the probit model, based on the relevant literature (Kovacova, M., Kliestik, T. 2017; de Haan, Leo and Kakes, Jan, A, 2012; Best and Wolf, 2015) [14, 8, 5]. Following Kovacova, M., Kliestik, T. (2017) [14] the probit model is given by:

$$P = 1\Phi(-x, \beta) = \Phi(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n) \quad \text{.....(7)}$$

The probit model, applied in the present work, is expressed in the following equation:

$$Y \left| \begin{matrix} Bankruptcy = 1\ bankruptcy\ risk \\ Bankruptcy = 0\ otherwise \end{matrix} \right. = \beta_0 + \beta_1 . ROA + \beta_2 . Digit + \beta_3 . Solvency + \beta_4 . Subsector + \gamma + \varepsilon$$

## RESULTS AND DISCUSSIONS

In the present study we have included 34 Bulgarian companies from the livestock sector. According to the indicator *Average annual staff*, these are medium and large firms. The study covers a five-year period from 2017 to 2021.

The result "Lack of bankruptcy risk" is marked with "no", while "Bankruptcy risk" is marked with "yes" on the basis of the resulting values, according to the applied method.

Thus, by using the Altman method, a result under 1.81 was noted in 11 firms. With the Springate method, values of Z< 0.862 were present in 21 firms. When applying the other two methods, the number of firms facing a bankruptcy risk was significantly lower. Thus, using the Poznanski method, only one of the firms was found to have a value of FD< 0.

With the Hadasik method, there were three firms whose financial state was forecast as unstable. The latter marked a value of ZHA< 0.

The used coefficients for solvency and financial sustainability also showed a higher number of firms whose financial condition was compromised.

Respectively, for ER – there were 13 firms, whose ratio of their own capital to the total asset value was less than 0.5.

The same number of firms had a ratio of their own capital to the sum of obligation less than 1. There were twelve firms with a debt coefficient DR> 0.5 and NCAFR< 1. The indicators WCAR and CR noted a complete match between the firms exceeding the threshold acceptable values, shown in Table 2, respectively- per 10 firms.

Table 3. Results – Bankruptcy risk determined by the applied methods

| ALTMAN | SPRINGATE | POZNANSKI | HADASIK | ER | EDR | DR | WCAR | NCAFR | CR |
|---|---|---|---|---|---|---|---|---|---|
| no | no | no | no | no | no | no | no | no | no |
| no | no | no | no | no | no | no | no | no | no |
| no | yes | no | no | no | no | no | no | no | no |
| yes | yes | no | no | yes | yes | yes | yes | yes | yes |
| no | yes | no | no | no | no | no | no | no | no |
| no | yes | no | no | yes | yes | no | no | no | no |
| no | yes | no | no | no | no | no | no | no | no |
| no | no | no | yes | no | no | no | no | no | no |
| yes | yes | no | no | no | no | no | yes | yes | yes |
| no | yes | no | no | yes | yes | yes | no | no | no |
| yes | yes | no | no | yes | yes | yes | yes | yes | yes |
| no | no | no | yes | yes | yes | yes | no | no | no |
| yes | yes | no | no | yes | yes | yes | no | no | no |
| yes | yes | no | no | yes | yes | yes | yes | yes | yes |
| no | no | no | no | no | no | no | no | no | no |
| yes | yes | no | no | no | no | no | yes | yes | yes |
| no | no | no | no | no | no | no | no | no | no |
| yes | yes | no | no | yes | yes | yes | yes | yes | yes |
| no | no | no | no | no | no | no | no | no | no |
| no | yes | no | no | no | no | no | no | yes | no |
| no | no | no | no | no | no | no | no | no | no |
| yes | yes | no | no | yes | yes | yes | yes | yes | yes |
| no | yes | no | no | no | no | no | no | no | no |
| no | no | no | no | no | no | no | no | no | no |
| yes | yes | no | no | yes | yes | yes | no | yes | no |
| no | yes | no | no | no | no | no | yes | yes | yes |
| yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| no | no | no | no | no | no | no | no | no | no |
| no | yes | no | no | no | no | no | no | no | no |
| no | no | no | no | no | no | no | no | yes | HE |
| yes | yes | no | no | yes | yes | yes | yes | yes | yes |
| no | yes | no | no | no | no | no | no | no | no |
| no | no | no | no | yes | yes | yes | no | no | no |
| no | no | no | no | no | no | no | no | no | no |

Source: own contribution.

The analysis shows that the Poznanski and Hadasik methods which were developed for firms working in Eastern Europe (Poland), are a little more lenient to enterprises that experience financial difficulties. At the same time, the western models of Altman and Springate show similar results to the methodology for financial sustainability and solvency.

Out of the analyzed companies, there was a single case of imminent bankruptcy, confirmed by all methods and indicators for financial sustainability. For confidential purposes, its name shall not be announced, but its activity will be traced for the next years to establish whether this certainty of the methods would be confirmed in time.

We believe that the applied methods of Altman and Springate may be used for bankruptcy risk analysis of Bulgarian livestock farms.

The same methods may inform about the deterioration of the firms' financial state, whereas the greater certainty of the bankruptcy prognosis may require the use of some Eastern European methods.

In order to acquire a clearer idea and to avoid listing excessive detail in the table, the information shows data for the period of one calendar year. With minute exceptions, some firms differ in the "yes" marker for bankruptcy risk, and "no" for the lack of risk throughout the years included in the observed period.

Most often, at the beginning of the studied period there is a notable risk, which diminishes with time.

In the following studies the authors will try to apply this methodology to the small firms of the same sector, and also to the large and medium-sized, despite the longer period of time.

The results from the model with fixed effects with independent variable have *ROA* been given in Table 4.

Table 4. Fixed effect results

| Roa | Coef | Std. Err. | P>\|z\| |
|---|---|---|---|
| Salesgrowth | .06654832 | .0301664 | .0063581 |
| Solvency | .0036244 | .0166627 | 0.828 |
| 1.bankruptcy | .0569097 | .0277784 | 0.040 |
| subsector | | | |
| Pigs | .0195137 | .0573571 | 0.734 |
| Birds | .0042707 | .055887 | 0.939 |
| Cons | .0793853 | .0585978 | 0.175 |
| sigma_u | .01823924 | | |
| sigma_e | .04710842 | | |
| Rho | .13036303 | | |

Source: Own contribution.

In the analysis of the results, it becomes evident that the bankruptcy risk is a

statistically significant indicator of the study which affects profitability. The enterprises with a high bankruptcy risk are characterized by lower total profitability of the assets, compared to firms with lower risk, evaluated by the Altman indicator. With respect to the fact that livestock farming is a sector with a low digitization degree, and the processes of digital transformation are at an early stage, we can assume that the costs for adopting a digital business model initially decrease the financial result. For a more complete study of this dependency, it would be appropriate to review it in a mid-term plan, by adding a lag variable to the model.

Unsurprisingly, the growth rate of the sales revenues has a positive, yet not very significant effect on the asset profitability.

The solvency coefficient also has a resulting negative impact on financial outcomes, however, the indicated effect is not statistically significant.

The results give a fair role to the individual characteristics of industrial enterprises. 13% of the unexplained dispersion of the return on assets is due to specific factors, originating from the separate firm.

The results from the Probit model with independent variable *Bankruptcy* have been presented in Table 5.

Table 5. Probit model results

| Bankruptcy | Coef. | Std. Err. | P>z |
|---|---|---|---|
| roa | -39.67996 | -2.24 | 0.025 |
| digit | -685.6778 | -1.71 | 0.087 |
| solvency | 5.715123 | 1.97 | 0.049 |
| subsector | | | |
| DairyCattle | 0 | | |
| Pigs | .8230865 | 0.85 | 0.396 |
| Birds | 0 | | |
| OtherAn | 0 | | |
| _cons | -2.927963 | -1.69 | |
| /lnsig2u | -12.90745 | | 883.4868 |
| sigma_u | .0015746 | | .6955884 |
| rho | 2.48e-06 | | .0021906 |

Source: Own contribution.

The likelihood of bankruptcy is increased with the reduced profitability of assets and the lower costs incurred for intangible assets. According to the results, the enterprises with over-indebtedness show a higher probability of going bankrupt.

In the results, we also observe a negative relationship between the risk of bankruptcy and the costs of innovation and digital transformation, but it is not statistically significant. However, the obtained value of 0.087 gives us reason to assume the existence of prerequisites for the impact of innovation and digital transformation costs on the risk of bankruptcy. That is, enterprises with lower costs show a higher probability of bankruptcy.

In both of the used models, the sector, in which the enterprises operates, does not have an impact on the studied variables.

## CONCLUSIONS

Agricultural enterprises face the challenge of accelerating the digital transformation of their operations, which can impact their solvency and performance. In this regard, this article compares the application of popular approaches for bankruptcy risk analysis. Using the Springgate method, compared to others, we determine the highest number of companies with an increased risk of bankruptcy (21 enterprises). The number of enterprises facing bankruptcy risk when applying the Altman method is 11. Using the following two models, a negligible number of firms face the risk of bankruptcy.

According to Hadasik's approach, an unstable financial situation is predicted for three enterprises, while according to Poznanski's method, only one company faces a risk of bankruptcy.

The solvency coefficients also show many companies with deteriorated financial health. Related to the WCAR and CR indicators, there is an even distribution between the companies that fall outside the threshold acceptable values.

The obtained results reveal that the methods of Poznanski and Hadasik show a higher tolerance towards enterprises experiencing financial difficulties. At the same time, the Western models of Altman and Springgate, as a result, are closer to the methodology for financial stability and solvency.

The econometric analysis clearly shows a statistically significant relationship between the risk of bankruptcy and the productivity of agricultural enterprises, measured by ROA. We observe a lower total return on assets for enterprises with a high bankruptcy risk, denoted by Altman's z-score. In analyzing productivity factors, we should note the relatively high significance of the enterprises' individual characteristics.

Applying the probit model reveals a higher probability of bankruptcy for firms with lower productivity and higher leverage.

Although it is not unambiguous, the obtained results give grounds for assumptions about the impact of innovation and digital transformation costs on the risk of bankruptcy.

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# THE ANALYSIS OF A COMPLEX COLLABORATIVE VALUE CHAIN. CASE OF AGROTRANSILVANIA CLUSTER

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***Abstract***

*A multifaceted and flexible partnership established to support the growth of the agro-industrial sector has produced the Value Chain of AgroTransilvania Cluster. Its goal is to aid in the growth of the association's and each member's competitiveness on both domestic and foreign markets. The aim of the article is to propose and set up an adequate strategy for assuring the common development of the AgroTransilvania Cluster. The analysis of internal and external ecosystem of the value chain of the AgroTransilvania Cluster – the material studied - was scrutinized using SWOT Analysis, used, aftercall, as groundwork for TOWS Matrix, completed by PESTEL analysis. The needs of the members of the cluster were identified using Delphi method, through questionnaires. The final result consists in a strategic planning document, so its implementation was assumed by the cluster's members, assuring their involvement in joint, multi- and trans-disciplinary research, development, innovation, technology transfer, service provision, production, increasing visibility and not. The final aim of the strategy is to successfully generate the transition from an emerging cluster to an innovative one.*

***Key words*****:** *collaboration, agri-food, strategic development, agribusiness*

## INTRODUCTION

The agri-food sector is, probably, one of the most sensitive Romanian economy's sectors, both through its interest at the national and European level, and through the complex issues that its own existence generates (Chifor et al, 2022) [4].

According to the "National Strategic Framework for the Sustainable Development of the Agri-Food Sector and the Rural Area in the Period 2014-2020-2030 - The National Rural Strategic Framework (Presidential Commission for Public Policies of the developmnet of agriculture in Romania/ Comisia Prezidențială pentru Politici Publice de Dezvoltare a Agriculturii în România, 2013) [17] developed by the Presidential Commission for Public Policies for the Development of Agriculture in Romania (where the General Manager of AgroTransilvania Cluster was one the active members) launched on July 1, 2013, Romania's agri-food industry faces significant challenges, the resolution of which necessitates a concerted effort not only at the central level but also at the regional and local levels.

Currently, it is desirable to have an adequate technical development of the rural territory, the localities, and the rural households; to use the local natural resources in the economic circuit; to protect the environment and nature; and, as a result of these, to have an acceptable standard of rural life.

The insertion of the producers from the agro-industrial sector in supply chains takes into account the context of the development of modern agriculture, being the main element around which an overall vision must be built (Arion, F., Muresan I., 2013) [1].

Subsidiarily, it is necessary to ensure a decent standard of living for farming families with the protection of the environment. The

development of non-agricultural branches as well as agriculture-related sectors is directly influenced by the rural economy in general and agriculture in particular because they both represent a sizable market for their upstream and downstream branches (Arion et al, 2017) [2].

The disadvantages of the Romanian food industry are also due to the quasi-lack of strong and recognized national and local brands in terms of quality, but also to the lack of value chain integration of producers, processors, processors and traders (Dumitras et al, 2016) [7].

According to the document developed by the European Commission "Framework for State aid for research and development" (European Commission: DG Competition, 2022) [8], clusters represent groups of independent companies that operate in a specific field and area in order to stimulate innovative activities, by encouraging close relationships, the sharing of resources, and the sharing of knowledge and experience and by contributing to technology transfer, networking and information dissemination among businesses in the cluster.

To encourage and to monitor clusters, the European Commission established the European Cluster Observatory in 2006, providing for the first time both quantitative and qualitative statistical data as well as comparative analyses on the situation of clusters in Europe. It also created the European Cluster Policy Group, which aims to improve, among Member States and the Commission, the degree of understanding of current policy actions in support of achieving a high level of cluster excellence (European Commission: DG for Internal Market, Industry, Entrepreneurship and SMEs, 2021) [9] identifying and evaluating effective and ineffective group support practices, and creating suggestions on how to enhance the Community's development of group policies; assessing international trends in group development and identifying future challenges within group policies in the context of globalization; analyzing the complementarities between the main policies and financial instruments at community level that support the groups, adopting conclusions and formulating recommendations; but especially the creation of links with the European Alliance of Groups and, as appropriate, with other initiatives in support of groups and group policies and extracting some lessons from their practical experiences (Török, 2015) [19].

A report carried on by the European Commission Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Unit F.2: Clusters, Social Economy and Entrepreneurship (Hollanders H., Merkelbach, I., 2020) [11] pointed out the relevance of cluster associations, proving that they are generating, in average, around 35% more productivity, also at most of the exporting industries, at least a half of the employers are integrated into clusters.

The cluster's goals align with both the goals of the Lisbon Strategy and the European Commission's cohesion policies and programs.

Actions to improve knowledge, economic growth and innovation were allocated the sum of 86 billion Euros for the period 2007-2013, and from this allocation, important sums were used to support cluster-type initiatives and infrastructures. Benefiting from these funds, in recent years, around 500 such organizations have been consolidated or created within the European Union.

This article is aiming a scientific gap identified to be the insufficient scientific knowledge the factors that affects the collaborative value chain of an agri-food cluster, especially in Romania.

The remaining of the article is presenting the analysed material (AgroTransilvania Cluster), the validity of methodology used, the main results and discussions, and, finally, the ending conclusions that are to be addressed.

## MATERIALS AND METHODS

### Material: AgroTransilvania Cluster

The name of the Association is "Clusterul Agro-Food-Ind Napoca", but, for a better visual identity, the AgroTransilvania Cluster trademark was registered at the State Office for Inventions and Trademarks.


Fig. 1. Registered Trade Mark of AgroTransilvania Cluster
Source: Official Bulletin of Industrial Ownership, Section Trademarks and Geographical indications no. 05/2014, p. 219 [14].

With the stated goal of increasing the association's and each member's competitiveness on the national and international markets, the cluster-type associative structure is a non-governmental, non-profit, independent association to support the development of the agro-industrial sector.
In 2019, AgroTransilvania Cluster was subjected to the benchmarking interview under the umbrella of the European Clusters of Excellence Initiative, through a uniform cluster management quality certification tool, in the form of the Performance Label - Cluster Organization Management Excellence Label (Quality Label). By means of benchmarking, an estimate of the cluster's performance was made in relation to other clusters in the same field of activity and it assumed a process of organizational adaptation, aimed at an improvement, a continuous process of identifying the best practices that lead to improved performance. The interview was organized to obtain the Gold Quality Label - Cluster Organization Management Excellence Label, being conducted by certified experts in Cluster Benchmarking. Gold Quality Label - Cluster Organization Management Excellence Label was awarded to AgroTransilvania Cluster later on in 2019.
The visibility of the cluster's activity has steadily improved, becoming more and more attractive to new potential members, from the 20 founding members to a total of 80 members today, and it becomes the subjects of diverse studies as example of good practice (Manukyan I., 2021) [12].
AgroTransilvania Cluster is a member of the Association of Clusters in Romania – CLUSTERO (CLUSTERO, 2023) [6] which represents the interests of the clusters at the national level and is involved in promotion, representation and negotiation activities.
It is also a part of Smart Transylvania, an association that brings together some of the most prominent clusters in the North-West Region, for better flexibility and relationship with regional policies, strategies and structures, a regional structure in the form of a consortium of clusters, Cluj being considered "the capital of clusters" (Neamtu, 2019) [13].
AgroTransilvania Cluster is a member of the Network of Clusters in the agri-food field in Romania, a collaborative network created to support the interests of clusters in the field at the national level and is involved in promotion, representation and negotiation activities.
AgroTransilvania Cluster benefits from the support of its members coming mainly from the economic environment, but also from the scientific, research environment and the authority of the county and local public administration, fulfilling the requests as being included in the category of clusters, according to the "Framework for State aid for research and development" (European Commission: DG Competition, 2022) [8].

**Methodology**

For identifying complexity of the collaborative value chain in case of AgroTransilvania Cluster, there were used the SWOT (Strengths, Weaknesses, Opportunities, Threats) and the PESTEL (Political, Economic, Sociological, Technological, Legal and Environmental) Analysis, based on the consultation of its members, run on 2013, 2015, 2019 and 2021. Then, the information analysed for formulating the future development strategy of the AgroTransilvania Cluster.
The use of SWOT Analysis, also know a SWOT Matrix, is widely used for identifying and for understands the strengths, weaknesses, opportunities, and threats which an entity confronts in a particular moment of time, and a related to a specific sector (Wang et all, 2015) [21]. The data gathered through SWOT Analysis served as the foundation for the TOWS Matrix: Strengths were used to maximize opportunities and to reduce threats.

Weaknesses were reduced by utilizing opportunities and avoiding threats.

The analysis proves its efficiency in the analysis of industrial clusters (Galtsova et all, 2020) [10] of clusters related to agri-food sector (Beloborodko et all, 2015) [3] and of agri-food clusters (Wu, 2014) [22].

PESTEL Analysis, also known as PESTLE Analysis, is framework or tool used useful to evaluate the macro-factors that potentially influences an entity (Yüksel, I., 2012) [23].

The method is widely used for analysing the clusters (Padmore, T., Gibson, H., 1998) [15] and is proved its viability of the agri-food sector, also (Panpatte, S., Ganeshkumar, C. 2021) [16].

Anyway, more scholars appreciate that SWOT Analysis and PESTEL Analysis should be combined (Christodoulou A, Cullinane K., 2019) [5] and even completed with other tools like Analytical Hierarchy Process (Tsangas et al., 2019) [20] or Multicriteria Decision Making (Srdjevic et all, 2012) [18].

The Delphi technique was used as a structured communication framework and forecasting process based on the responses to questionnaires distributed to the members of AgroTransilvania Cluster. An aggregated summary of the previous round's responses was provided to the members, enabling them to modify their responses in light of the group's response. The advantages of expert analysis and elements of the wisdom of crowds were combined in this process.

A similar combination was used for setting up the analysis of the complex factors that affect the collaborative process on the value chain of AgroTransilvania. As, a final result, the strategic objectives of the entity were set up.

## RESULTS AND DISCUSSIONS

Between 25.03.2020 and 12.05.2020 AgroTransilvania Cluster applied the questionnaire dedicated to updating the strategy and development of the cluster. In the mentioned interval, a number of 43 entities affiliated to the cluster responded to this questionnaire out of a total of 78 entities. According to the analysed data, over 50% of the cluster's entities were involved in the process of updating the strategy.

The applied questionnaire included a number of 26 questions intended to collect information about the interests of the members regarding subjects such as: the current market, the premises for expansion and development in other markets, products with added value and with certification potential. In addition to the previously mentioned, the questionnaire also focused on innovation capacity and members' intention to get involved in CDI activities.

The first 7 questions were focused on collecting general data about the respondents, so that they requested information about the company, the legal representative, the main and secondary CAEN codes, but also about the financial indicators and the number of employees. Questions 1-7 by their specificity do not require a unitary interpretation, they provide general data about the respondents. Both main and secondary CAEN codes cover the value chain in the agri-food sector, given the fact that the role of the cluster is to integrate the economic actors in the value chain, it is considered that the relevance is given precisely by this diversity of the fields of activity: research institutes, the environment academic, economic agents. Questions 8-10 were aimed at identifying information about the current market and the intention to expand.

It emerged that 67.4% of all respondents sell their products/services on the domestic market, while 18.6% also export, but the main market is the domestic one. The intention of the members is to expand to foreign markets 56.8%, most of them target European markets. Following the analysis of the answers given to the two previous questions, the members' interest in business internationalization can be observed. Even if at the moment the sales market is predominantly national, international expansion is also among their objectives.

Questions 10 - 12 were aimed at identifying products with added value or with certification potential. In Transylvania there is potential for product certification so that through these questions the identification of

potential products was pursued. As can be seen from the answers provided, the members of the cluster have both certified products and services. In addition to the already certified products/services, they also mentioned some products/services with certification potential, which provides the premise that through collaboration and involvement, these advantages can be brought to fruition.

Questions 13 – 25 focused on collecting data on the role and importance of innovation for business, what are the companies' objectives regarding this component. The trend of the markets at national and European level is mainly based on the ability of companies to innovate, so the identification of information regarding this trend and the opinion of the members was considered essential. 79.1% believe that innovation is a basic component for a company to be competitive on the market, while 9.3% do not see it as a factor that can influence the market share obtained by the company, and they believe that a important factor to consider for customer satisfaction is the innovation component, 69.8% of the total number of respondents gave full agreement to the question "is innovation necessary to satisfy customer needs?"

According to the analyzed data, it can be observed that the respondents would turn to consulting in the development of international partnerships and consulting in the field of branding and marketing. In addition to the previously mentioned trainings and training courses as well as consultancy in the development of new services/products/product design are among the services of interest to the members that they would contract.

After analyzing the data collected regarding the innovation component, it can be stated that entities consider innovation important for customer satisfaction and competitiveness. In addition to the mentioned, among the objectives of the companies there is also the CDI component and the fact that they would call on certain innovation services. It should be emphasized that investments in CDI infrastructures would be more attractive if they were financed within the framework of research and development projects. 74.4% of respondents consider it important to create a common brand at cluster level, while 23.3% would prefer the development of brands at company level.

The results of SWOT Analysis and of PESTEL Analyses are complex and the restrictions of a scientific do not allow to present them into details, so the most relevant ones were selected. Each of the findings is further analysed and actions are designed for a better design of the future strategy of the cluster.

**SWOT Analysis**

The AgroTransilvania Cluster's management and members are both aware of the weaknesses and threats present, but more importantly, they are aware of the significance and necessity of eradicating and mitigating their effects.

For each weak point of the cluster, as well as for each threat, the possibilities to overcome them have been analysed and identified so that the strong points of the cluster can be highlighted and implemented to obtain the greatest advantages by using the potential offered by opportunities.

**1. Strengths**. There were identified a sum of internal elements that can provide strength to the cluster, including:

- It is a heterogenous consortium of entities, research institutions, universities, companies from various fields, but with common interests and with expertise and experience in the development of the sector.
- It represents a strategic alliance at local and regional level, created and led by/by the need to achieve positive results in economic activity.
- It benefits of the positive image transfer from cluster members to the cluster, among consumers, business partners and the general public.
- It has a distinct and strong local identity.
- It proved openness to the new, to research, innovation, technological transfer and development of cluster members, due to the market openness of most members who are SMEs focused on continuous adaptation to market and consumer requirements.

- It developed strategic and long-term alliances with public administration and education and research institutions.
- It can use a highly qualified permanent team, experienced in conducting studies and implementing development and investment projects, having a positive attitude in solving the problems of the cluster and its members.
- The active involvement of members in the process of ensuring the income of the cluster, through membership fees.
- Acceptance of new members into the cluster is a decision of the majority of members and not of the executive management team.

**2. Weaknesses.** Nevertheless, there are factors that are to be kept under control:

- Some cluster members lack the necessary knowledge, expertise, and background to operate a cluster effectively. As improvement actions were identified: Taking part in timely actions that are specific to each member's competencies alongside members of the executive management team.

- Some members' inexperience in raising money for one-time projects. Improvement activities. Improvement actions: Several projects are prepared jointly by the members under the cluster's coordination.

- Some cluster's members lack the necessary experience to manage joint development projects and, implicitly, to function as part of a complex team. Improvement actions: involvement of cluster members in timely actions that are relevant to each member's competencies, along with members of the executive management team.
- Inadequate value chain coverage, particularly in regards to some inputs for the food and agricultural industries, but also in terms of accessibility to consumers. Improvement actions: Enticing new participants, particularly in delicate circumstances. Since its founding, the cluster has grown to include a variety of productive, related industries that supply goods and services to the cluster's commercial sector.
- Due to the need for consultation with and input from every member of the cluster, the large number of members causes a delay in the adoption of decisions. Improvement actions: the cluster members' constant and open communication, reducing the amount of time spent during meetings on understanding the subject of adoption.
- Some of the members, who are SMEs, have limited resources and skills, but a short-term vision of the business, towards survival. Improvement actions: Integrating point views into a common strategy in which each finds its distinct place and increasing the efficiency of the use of resources by integrating them into a value chain.
- Insufficient experience of the young members of the executive team of the cluster to cover the lack of management people, at the time of their unavailability. Improvement actions: Their gradual involvement in the process of adopting decisions and delegating authority to obtain, through their own experience, the necessary skills.
- The existence of a single point of contact for the cluster and several specialized persons for various specific actions. Improvement actions: Using the headquarters of the cluster members as information points on the common activity and organizing the permanence of the activity of the central office.

**3. Opportunities.** The potential to seize the opportunities that have been identified has a direct bearing on how AgroTransilvania will develop in the future:

- The city of Cluj-Napoca is close by, and it has a sizable local consumer base (more than 300,000 people), to which is added the sizable number of people who are only in the city temporarily (students, businesspeople, visitors, etc.). ).

- The land's potential for agriculture and food production, which is underutilized in comparison to the outcomes that can be achieved.

- Promising long-term prospects for the growth of agri-food businesses at local, regional, national, and international levels (driven by the steady rise in agri-food product consumption, particularly in Europe and Asia).

- Local food businesses can develop a medium- and long-term strategy by taking into account global consumption trends and changes in the food market.

- The consumption of processed and innovative food products is increasing worldwide, and by making production processes more efficient, the percentage of transport costs in the total cost is becoming higher, thus there is a tendency to orientate production based on local inputs.
- There will be more demand for the agri-food products that cluster members can provide as a result of the opportunities related to food security, product availability, distinctive flavor, and durability, as well as the current trend of increasing the visibility of product traceability and increasing the attractiveness of local and/or traditional products.
- A more effective use of the resources currently used by cluster members, through integration into the cluster's common value chain and, implicitly, a decrease in the cost of unit production.
- The possibility of accessing financing funds for business development that are only available to associative forms.
- Easier access to innovation, development, research, through immediate access to the final results of the research activity of specialized members (universities, Chamber of Commerce and Industry).
- Facilitation of investment or development projects in partnership, given the partnership already created.

**4.Threats.** There were found out issues that negatively affects the cluster.

- The absence of sufficient infrastructure for the region's agri-food industry, which would guarantee a balanced presence of colleges, research centers, government organizations, small and medium-sized businesses, and producers. Possible countermeasures include creating a complete network and advertising it by taking part in high-profile events to interested actors and the general public.

- A lack of understanding of the agricultural and agri-food industry in the region, particularly in light of the aggressive land fund fragmentation that results in the instability of productions from both a qualitative and quantitative point of view. Countermeasures: Carrying out the study "A chance for every farmer" to determine the opportunities of the sector and to determine the concrete possibilities of using the available resources in the direction of the development of associative productive forms.
- Multinational corporations engaged in fierce and unfair competition on the Romanian market, particularly in terms of pricing and sales practices, by combining well-built networks that integrate the entire value chain. Countermeasures: Value chain integration of cluster members to reduce production costs and attract development funds.
- Small bargaining power in the face of large retail chains, especially at the level of supermarkets and hypermarkets. Countermeasures: Create a locally and regionally promoted brand that consumers are familiar with, appreciate, and demand from stores. As an alternative, specialized stores with local, traditional and cluster-certified products will be created.

- The cluster members' inability to access cutting-edge production technologies, which drives up production costs. Countermeasures: Pooling human, financial, and capital resources to draw sizable investments that add value for a number of cluster members.

- A lack of experienced and technologically qualified workers affects the agri-food industry, and implicitly, the cluster's members. Countermeasures: practical requirements should be compatible with those provided by universities and specialized schools, and cluster members who have graduated from partner universities should have easier access to the labor market.
- Increasing pressure from European and national government agencies to over-regulate "food safety" and consumer hygiene and health issues. Countermeasures: Anticipation, through studies and research results, of these regulations and early preparation of the transition period until their practical application.

- The conservative attitude at the level of the agro-food sector towards innovative technologies and towards their development and implementation requirements (ISO certification, HACCP, etc.). Countermeasures: Promotion of the need for quality certification at the level of the cluster and business

partners, as well as the development of upcoming relationships, particularly with those partners who have high quality standards and are certified.

- The media's campaign against obesity, diabetes, and other illnesses linked to the consumption of food products has an impact on how the activity sector is perceived, particularly with regard to new products that consumers are not familiar with. Countermeasures: Promotion of a personal brand that is linked to a high-quality and wholesome image.

- Potentially intensifying competition with other cluster forms or similar associative forms that will emerge in the future. Countermeasures: The development of skills and abilities generated by the experience of involvement in such structures, which provide a comparative advantage over the newly created structures.

**PESTEL Analysis**

The way in which external factors leave their mark on the agro-industrial cluster can be observed in the PESTEL Analysis. Like any entity, the cluster is not immune to the influences of political, economic, social, technical, environmental and legislative factors - regardless of whether they are local, regional, national or transnational, and knowing them in order to emphasize the positive effects and diminish the negative ones is a desirable continuous of its members.

**Political**

The political factors are not to be neglected:

- The lack of a pact on agriculture and the food industry at the level of the political class that is assumed by all political parties.
- Political instability generated by the need to form governing coalitions.
- Reorganization of the central and local administration structures, as an immediate effect of the changes on the political scene.
- The lack of resources available to the territorial structures on the ground as a result of the sharp reduction in the number of employees at the County Agricultural Directorates and other organizations.
- Delays in the establishment and effective operation of the Cluj Chamber of Agriculture due to divergent perspectives on its function.
- Local political interests that are often divergent and aim to achieve competitive objectives in terms of the requested resources.

***Possible effects*** of the political factors include:

- The inconsistency of the cluster's plans and strategies in the medium and long term, leading to reduced levels of efficiency.
- Lack of political support or even political opposition in the application of trans-local projects.
- Lack of coherent and constant and timely information from the territory to be used by cluster members.

***Measures*** identified to be possible used for limiting the effects of political factors are:

- the continuous study of the political environment in order to anticipate the adopted measures.
- staff training in communication, risk management and change management.
- the multidisciplinary and sustainable development of the cluster, so that political changes do not affect its efficiency and effectiveness.

**Economic**

They are the most obvious one, on frame of this analysis:

- The pressure of multinational companies, which, as a result of economies of scale, impose low prices that are difficult for small companies to match.
- The difficult specific requirements of supermarkets and hypermarkets for local agri-food products (quantity, quality, fluency, packaging, delivery location, marketing prices, etc.)
- The influence of economic interests (prices, bargaining power) is stronger than local interest, such as developing a strong local agri-food sector and renouncing imports
- The relatively low level of wages for highly skilled people which has effects on the migration of skilled labor
- The increase in mobility abroad and the increase in the standard of living lead to an increase in consumer expectations regarding the quality of agri-food products
- The instability of national economic and monetary policies, including the exchange rate and the level of inflation, with direct effects

on the purchasing power of consumers and on foreign trade policy.
- The economic crisis that has the effect of increasing the price elasticity of basic products, such as agri-food products

***Possible effects*** identified are:
- forcing the reduction of production costs even at the risk of reducing quality.
- the need to find alternative ways of marketing the cluster's products.
- the need to adapt the cluster's product offer to face (in terms of presentation, availability, weight, etc.) the competition.

***Measures*** that could balance the economic factors are:
- the continuous study of the economic environment in order to anticipate the adopted measures.
- staff training in economic, marketing, financial, economic analysis.
- investments in public relations and informational campaigns aimed at making regional, traditional goods more appealing than those produced by multinational corporations.

**Sociological**
- Shifts in the social and demographic makeup of the population that makes up the cluster's and its members' potential consumers.
- Shifts in the culture and mentality of the people who make up the cluster's and its members' potential customers.
- The existence of unfavourable attitudes (non-compliance with hygiene standards, non-compliance with food safety, non-compliance with manufacturing processes) regarding agri-food products, especially local ones that have not benefited from a sustained advertising campaign.
- Fear of involvement in projects, as a result of the lack of previous experience.
- The reluctance of small agricultural producers to join any associative forms for fear of losing their identity and freedom of decision.
- Increasing pressure to ensure food security and safety as a fundamental element of social security.

**Possible effects**
- The need for continuous and rapid adaptation of the cluster's agro-food products to the changing demands of consumers.
- Reducing the life cycle of the cluster's products, thus implying increasing investments in innovation and the development of new products.
- Difficulties in creating effective lasting partnerships or in attracting new members and partners to ensure the partnership.

**Measures**
- The continuous study of the social, cultural and demographic environment in order to anticipate the measures that need to be adopted.
- Staff training in the field of communication, sociology, consumer behavior.
- Investments in advertising and information campaigns in order to create a favorable image and increase the attractiveness of local, traditional products to the detriment of those industrialized globally.

**Technological**
- The pressure of the emergence of new production technologies both in agriculture and in the food industry sector.
- Increased pressure to ensure and increase the quality of production technologies.
- Rapid obsolescence of production technologies leading to increased pressure to secure funds for investment in new technologies.
- Increasing requirements regarding the reduction of negative externalities of production processes (reduction of pollution, compliance with environmental measures, reduction of soil erosion, reduction of energy consumption, etc.).

**Possible effects**
- The need to secure investment funds and the accelerated depreciation of investments.
- The need for continuous adaptation of technologies according to safety and environmental requirements.

**Measures**
- The continuous study of new trends in the development of technologies, in order to anticipate the measures that need to be adopted.
- Staff training in the technical and technological field.
- Participation in events and fairs in order to be up to date with emerging technological

changes.

**Legal**

- The strong pressure on the national and local business environment generated by continuous changes in legislation at European level
- Delays in the adoption of legislative measures with effects on the instability of the sector
- Problems regarding the inconsistency of some legislative acts in the field.

**Possible effects**

- inconsistency in the operation of the cluster in the short, medium and long term, due to the legislative ambiguity and instability.
- lack of coherent and constant and timely information from the territory to be used by cluster members.

**Measures**

- Continuous study of the legislative environment in order to anticipate the effects of the adopted regulations.
- Staff training in the field of knowledge of laws and regulations.

**Environmental**

- Aggravation of environmental pollution phenomena (with nitrates, soil erosion, water and air pollution, etc.) generated or not by the agro-industrial sector but leading to new quality standards.
- The dependence of the agricultural sector in the area on pedo-climatic conditions and environmental conditions, generated by the lack of anti-hail systems, the lack of irrigation systems, etc.
- The risk of the occurrence of natural disasters (severe droughts, heavy rains, frosts, etc.) that may endanger plant and animal agricultural production, and implicitly the increase of the food industry's dependence on imports.

**Possible effects**

- the need for active involvement in the preservation and regeneration of the environment, not only in limiting the negative effects on it.
- the need for continuous adaptation of technologies according to safety and environmental requirements.

**Measures**

- the continuous study of environmental quality indicators in order to anticipate the measures that need to be adopted.
- staff training in the area of preventing adverse environmental effects.
- coming up with development strategies that are environmentally friendly and spreading the word about them to the public in order to boost the cluster's reputation at the time.

Critical interpretation of the information from the SWOT Analysis and PESTEL Analysis of the AgroTransilvania Cluster leads to the conclusion that both weaknesses and threats can be countered with a very high chance of success by means of the strengths of the cluster and the opportunities available to it.In conclusion, it can be stated that there are the prerequisites not only for the survival of the cluster, but also for a harmonious development in the short, medium and long term.

Based on these findings, six strategic objectives were determined which, although relatively autonomous, are interdependent and are constitutive of a unitary whole:

OS.1. Expanding RDI capabilities in the bioeconomy sector and enhancing the region's standing as a cutting-edge hub for intelligent specialization on a national and international scale.

OS.2. Fostering the growth of regional and local initiatives to boost the competitiveness of the Transylvanian agro-industrial sector.

OS.3. Developing entrepreneurial skills and ensuring the quality of the workforce.

OS.4. Encouraging the creation and/or development of associative structures.

OS.5. Integration of producers and associative structures in the value chain.

OS.6. Increase qualitative and quantitative representativeness.

By achieving these strategic goals, the cluster will develop and become recognized by the business community in the agro-industrial sector at the local, national, and European levels, especially by providing innovative products and services and by transferring technology to the local, regional, national, international market. It is an objective assumed by the cluster and by each individual member, to focus mainly on selling production to local, internal markets. This will

have the result of improving the visibility and trust in the cluster and its products and services locally, nationally, and intentionally. This will have a positive impact on the economic environment in which it operates. It will also increase the competitiveness of the cluster members relative to the competition by reducing costs as a result of their activity's integration.

The activities of the cluster intended to be carried out in the short and medium term arise from the operational objectives that the cluster proposes to carry out in order to achieve the strategic objectives, and, finally, to put into practice the vision and mission of the cluster, previously mentioned. In order to monitor the results of the actions of the agro-industrial cluster, a series of quantifiable indicators, specific to each individual action, are foreseen (turnover, number of enterprises, value of exports, number of employees, number of employees with higher education, R&D expenses, number of companies that introduced process/marketing/organizational innovation, number of companies that introduced product innovation, number of companies that innovate in partnership, number of patents (trademarks, industrial designs, etc.)). Monitoring includes not only checking the degree to which the proposed results have been achieved, by simply assessing the value of the indicators, but also respecting the time horizon and the budget of resources (financial, human, etc.) foreseen.

## CONCLUSIONS

As can be seen, the premises for the development of the members are based both on the expansion on international markets and on innovation activities. The interest shown for R&D activities is due to the fact that in the view of the members, innovation can lead to increasing the competitiveness of companies and also to customer satisfaction.

According to the previously analyzed data, it can be mentioned that the entities want to get involved in CDI activities implicitly by allocating resources. The funded research-development projects, together with state support, can contribute, in the members' view, to increasing the degree of innovation of economic entities.

The creation of a common brand of the Cluster is a vision shared by the entities in the cluster, and together the internationalization activities and the development of new products and processes of interest to them can contribute to the development and fulfilment of the long-term objectives of the entities.

The study proved the positive effect of collaborative value chains and it can bring new scientific, administrative and practical perspectives on the subject. As can be seen, the cluster should adopt a complex system of quantifiable indicators, easy to follow, in order to be able to continuously monitor their evolution and, if necessary, to intervene along the way in the direction of their correction. Increased economic competitiveness and cluster-wide growth will result from the expansion of the activities and the execution of the planned investments.

It can be concluded that the sustainability of the such initiative as AgroTransilvania Cluster is a desirable *sine qua non* and will be ensured by a good practice within the activities carried out by the cluster, the improvements brought to the sector acquired along the way will be a well-earned asset and will be perpetuated in the years to come.

Future generations will gain from the advantages gained, the investments made, and the information gathered, making them better prepared for the economic environment, as well as the multiplier and multifunctional effect generated by the cluster.

As in the past, the growth of cooperative ties between cluster members and between the cluster and the economic environment will make it easier for people to access not only the labor market but also, implicitly, the exchange of good practices, which is essential for developing the practical skills required for the future growth of the business environment.

The limits of the study imply the fact that the case study is specific and some of the findings of the study cannot be easily replicate or generalised. Similar studies have to be carried on for a better understand of the phenomena.

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# ONLINE FOOD PURCHASING DURING COVID-19 PANDEMIC

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***Abstract***

*Covid-19 pandemic led to many disturbances in everyday life, including regular supplies with medicines and food especially during quarantine. The present study aimed to investigate the way the pandemic affected the food chain based on consumers` preferences for e-shopping of food products. An anonymous questionnaire was distributed before the pandemic in February-March 2020 and later in September 2020-March 2021 among 470 Bulgarian citizens in total. The survey showed that for 43.4% of the respondents "Online shop/ E-shop/ E-market" was the most preferred online channel for ordering/purchasing food. The reasons for choosing internet shopping varied: convenience of purchase (19.6%); no physical attendance (6.4%); fresh products (3.8%); comparison of prices (8.5%); lack of preferred products on the conventional market (11.1%); finding products from distant markets (10.9%); health issues/isolation (0.2%). There were several types of products purchased via internet: food from animal origin (6.2%); fruits & vegetables (2.6%); organic food (18.1%); delicacies/exquisite products (8.5%); honey & bee products (5.5%); medicinal food/additives (12.3%); confectionery (7.7%); pet food (0.6%); cooked meals (1.3%). In conclusion, food purchased online was significantly increased during the Covid-19 epidemic and afterwards due to changes in the consumers` demands.*

***Key words*****:** *consumers, Covid-19, e-trade, food*

## INTRODUCTION

Trade in food products for human consumption is an activity that both at micro- and macro level contributes to increased diversity of products offered. At the same time, it could be said that it leads to uneven food distribution and security which is a result of many complex factors, among which fall the global food crises (Xu, 2019) [48] that pose the need for restructuring of the global food trade and production and food security, especially after the Covid-19 outbreak (Lugo-Morin, 2020) [29]. As stated by Gombkötő (2017) [17] the structure of trade in agricultural and food products has changed increasingly towards the higher-value food products during the past decades. It is estimated that in present time food production generates significant added value and is the largest economy in the world (Kirechev & Petev, 2021) [24]. However, the largest share of agricultural exports is transacted mainly within the regions with exception of the European Union (EU) and the USA as the largest trading partners all over the world (Gombkötő, 2017) [17]. Studies on the agri-food chains in the EU (Voicilas et al., 2017) [44] showed that stimulated by the EU policies new markets will develop and expand, driven by increased attention for conscious food choices, sustainable production and locally produced food. Combined with the consequences after the global health pandemic, the consumers grow very concerned about their health and food choices (Latip et. al., 2020) [27] and some of them even boost their belief towards food organic consumption (Hassen et al., 2020) [19]. Considering the changes in the consumers` behaviour and the restructuring of the food market, business oriented individuals took the opportunities created by the implemented sanitary measures for control of the pandemic (e.g., confinement, social distancing, and closure of local and national borders) (Lugo-Morin, 2020) [29] to sell their products, employing multiple ways and platforms (Limon, 2021) [28], many of them connected to e-trade. As defined by Alam (2019) [2] e-trade means e-goods and e-service which are rapidly expanding currently, e.g. over 50% of EU consumers have made an online purchase in the period 2018 – 2019 (Genchev, 2020) [15]. Moreover, Alcedo et al. (2022) [3] observed a long-lasting shift to e-

commerce activities in the retail and food sector. The behaviour and perception of people for e-shopping of food for convenience were studied by a range of authors, even at the pre-Covid-19 stage (Sethu & Saini, 2016; Rathore & Chaudhary, 2018) [38, 35] but after the pandemic in the view of the New Normal, the citizens further shifted their purchasing intentions toward online channels due to safety reasons (Latip et al., 2021) [26].
In this context, the purpose of the paper is to evaluate in what measure the pandemic affected the food chain based on consumers` preferences for e-shopping of food products.

## MATERIALS AND METHODS

### *Design of Survey*

An anonymous questionnaire was distributed before the pandemic in February-March 2020 and later in September 2020-March 2021 among 470 Bulgarian citizens in total. The participants were students at Trakia University who were given a paper questionnaire to fill it in anonymity with additional four more questionnaires for distribution to family members and friends. The respondents, thus, represented heterogenous groups throughout the country. This study did not need ethics approval.
The questions in the survey were distributed in several sections. Briefly, the first section (questions 1–4) contained questions on the participant's demographic data, such as gender, residence (capital city, city-administrative centre, small town, village), occupation with correspondent age range and educational background. The second section (questions 5-8) focused on the respondents` choices of online channels for food shopping, main driving factors toward e-shopping and types of food purchased online. The third section (questions 9) contained statements about the respondents` online purchasing behaviour during the pre-Covid-19 outbreak and afterwards.

### *Statistical Analysis*

All data received were numerically coded for easier processing of textual statements and statistically analysed (IBM SPSS-Inc., 2019, SPSS Reference Guide 26 SPSS, Chicago, USA). The study parameters were analysed through descriptive statistics (frequency distribution tables), and Student t-test. A two-tailed $p<0.05$ was considered significant. The results afterwards were presented on diagrams (Excel, Windows 10).

## RESULTS AND DISCUSSIONS

Respondents` demographics varied in gender, residence and occupation (Table 1). Most of the participants in the survey were women (59.4%), while in terms of occupation almost half of them (48.5%) were studying for their university degree (representing age range 18-25) or being employed (mostly in the range 30-60). In consistence with our study come the findings of Latip et al. (2021) [26] who studied the food purchase in the "New Normal" after Covid-19 epidemic who found that female respondents (67.3%) outnumbered male respondents (32.7%), with majority of them aged between 21 to 30 years old (58.5%) and with an academic background (45.5%). Even higher proportion was reported by Beliya et al. (2019) [6] in a study on consumers` satisfaction by using online food services, showing that 77.5% of their respondents were represented by the age group of 18 – 25 years, mainly college students. The same authors argue that people between the age group of 18-30 years were using the online food services more than any other age group which could be linked to our study with a share of 48.5% university students aged 18-25 years and found to have preferences for use of Applications and Online platforms for purchase and sale ($t[468]=4.936$, $p=0.000$).
Based on their residential area most of the participants in our survey were with urban background, living in the capital city and administrative cities throughout the country (91.3% in total), while only 8.1% of them come from rural settings (towns and villages). In similar studies in other countries regarding online food shopping (Wang & Somogyi, 2018) [46] the participants were also from big administrative cities including capital with distinctive online-food-pioneer characteristics (58%), showing innovation-adoption attitude.

At the same time, Hatim et al. (2019) [20] stated that through some mobile applications a diverse range of different types of food was delivered in city areas but also a particular application offered e-service in rural areas and small towns, thus assisting residential students. Similarly, alternative food networks with strong connection to the territory appeared as new forms of food distribution (Arcidiacono, 2018) [4]. However, there was no statistically significant difference in our study between the respondents` residential area and their use of online food platforms or applications ($t[465]= -1.615$, $p>0.05$).

Table 1. Demographic profile of consumers who purchase food online*

| Respondents` Demographics | Count | Percentage |
|---|---|---|
| ***Gender*** | | |
| 1) Female | 279 | 59.4 |
| 2) Male | 191 | 40.6 |
| ***Residence*** | | |
| 1) Capital city | 50 | 10.6 |
| 2) City–Regional administrative centre | 288 | 61.3 |
| 3) City–Municipal administrative centre | 91 | 19.4 |
| 4) Town | 7 | 1.5 |
| 5) Village | 31 | 6.6 |
| ***Occupation (Corresponding age)*** | | |
| 1) High school student (<18 years old) | 19 | 4.0 |
| 2) University student (18-25 years old) | 228 | 48.5 |
| 3) Unemployed | 12 | 2.6 |
| 4) Employed (25-60 years old) | 204 | 43.4 |
| 5) Retired (60 > years old) | 7 | 1.5 |
| ***Online channels for ordering/purchasing food*** | | |
| 1) Online shop/ E-shop/ E-market | 204 | 43.4 |
| 2) Online platform for purchase and sale/Applications | 66 | 14.0 |
| 3) Social networks (e.g. Facebook pages) | 86 | 18.3 |
| 4) Website of a restaurant | 1 | 0.2 |
| 5) More than one | 111 | 23.6 |
| ***Participation in the survey*** | | |
| 1) Period before Covid-19 outbreak | 77 | 16.4 |
| 2) Period during and after Covid-19 outbreak | 393 | 83.6 |

*Due to rounding of values some indicators may not sum up to 100%
Source: Author`s data from the questionnaire survey.

Based on the respondents' considerations for use of online channels for ordering and purchasing food, the majority of them prefer to use e-markets and online shops (43.4%), followed by online platform for purchase and sale/mobile applications (14.0%) and social networks (e.g. Facebook pages of shops, markets, farmers) - 18.3%. Some studies argued that online food delivery platforms connected restaurants owners, and customers who wish to order meals and receive them at home or office (Segura & Correa, 2019) [37] which was also chosen by some of our respondents through applications as Takeaway.com and glovoapp.com, instead of direct order from the restaurant website (only 0.2% of the participants). All the listed preferences in our survey fall among the channels for internet sales of food as described by the EC-SANTE (2018) [13]: own website of producer, trader (intermediary) or retailer's website and online platforms while retailers and individuals without a website may sell their products via sales platforms or social media networks. In the last years, due to the emergence of mobile devices with wireless technologies especially in the hospitality industry, there was a significant advancement of food ordering systems (Hatim et al., 2019) [20], causing a boom in online ordering and delivery traffic (Ganapathi & Abu-Shanab, 2020) [14]. Huge changes in consumers` purchasing process were attributed to electronic trade and digital marketing (Pınarbaşı & Akpınar, 2020; Sulaiman et al., 2020) [32, 42] as the use of social media and mobile applications for food orders appear to enhance the online sales of business operators to the community (Mohamed et al., 2022) [30], especially small entrepreneurs on the food market (Bruma et al., 2020) [7]. This approach is extremely important for countries like Bulgaria as almost 90% of the enterprises in the national agri-food sector are small or medium-sized (Kirechev & Petev, 2021) [24].

The tendency in increasing e-trade in food and food products was confirmed through our study as well – the use of online platforms and mobile food delivery applications was statistically significantly dependent on the consumers` changes in their purchasing behaviour in the period when the Corona virus outbreak was registered and afterwards ($t[468]= 8.388$, $p=0.000$). Similar changes in the society were found by Njomane & Telukdarie (2022) [31] who reported that more than 80% of the consumers shifted towards e-shopping during the Covid-19 epidemic. These results fully coincided with our survey as 83.6% of the respondents confirmed their changing shopping attitudes

during the corona virus health crisis toward online channels instead of conventional markets and retail outlets, thus weakening the HoReCa sector (hotels, restaurants, bars, catering businesses) (Dudek & Śpiewak, 2022) [12]. As market channels were shut down during the pandemic, food business operators and farmers had to urgently seek other alternative outlets to sell out their perishable goods, thus contributing to the shift in the purchasing intentions of the clients (Kamel et al., 2020) [22]. The way the consumers` behaviour changed during the Covid-19 outbreak was related by Sheth (2020) [39] to growing use of digital technologies and over-stocking of goods at home, confirmed also by Wang & Gao (2021) [45] who reported increased demand in food. Based on the findings of Njomane & Telukdarie (2022) [31] the recorded increased amounts of consumed food were effects from the epidemic due to boredom and wastage.

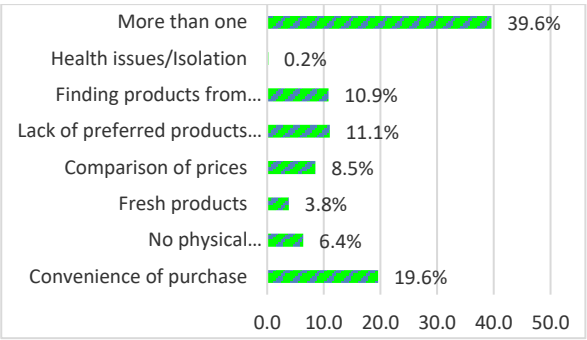


Fig. 1. Main factors that motivate consumers to choose e-shopping
Source: Author`s data from the questionnaire survey.

The aforementioned changes in purchasing behaviour in favour of online shopping could be explained with several reasons (Fig. 1): convenience of purchase like easy order and timely delivery to home/office (preferred by 19.6% of our respondents); lack of preferred products on the conventional market (11.1%); finding products from distant markets, e.g. from different residence (10.9%); possibility for comparing product prices between different e-channels (8.5%); no need for physical attendance to the markets (6.4%) which could also be combined with the lockdown/isolation measures during the Covid-19 outbreak (0.2%). Similar motives were reported by other authors with focus on the restriction on in-person shopping and social distancing (Schmidt et al., 2020; Njomane & Telukdarie, 2022) [31, 36] and convenient delivery at the doorstep (Belya et al., 2019; Hatim et al., 2019) [6, 20] with decreased visit frequency to markets (Cranfield, 2020; Vall et al., 2021; Hambardzumyan & Gevorgyan, 2022) [9, 43, 18]. Known that food purchasing is income-related, in the terms of food insecurity and expected income reductions during the crisis (Godrich et al., 2022) [16], people were also expected to fall in demand for some premium priced food products towards some other value-priced and non-niche equivalents (Cranfield, 2020; Husain et al., 2020; Barman et al., 2021; Godrich et al., 2022) [9, 21, 5, 16] and compare the prices of food products between the online food platforms as stated in our survey. One of the factors with statistical significance that drove the consumers` toward adoption of e-shopping behaviour during the Covid-19 epidemic was the lack of particular preferred goods on the conventional markets ($t[470]= 26.320$, $p=0.000$). The explanation could be found in the disruption of food supply chains at each stage of farm output and food processing, transportation and logistics (Deconinck et al., 2020) [11] due to the lockdown policies and the obstacles for the international trade (Sterev, 2021) [41].

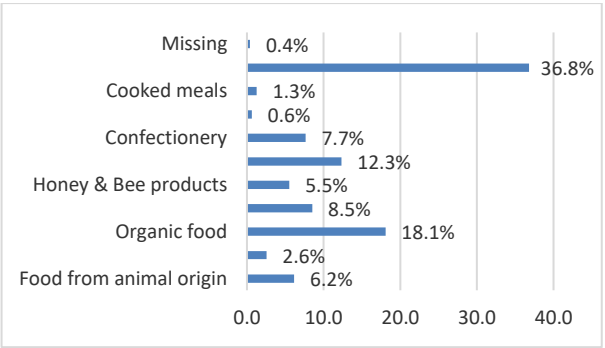


Fig. 2. General types of conventional and organic food products purchased via e-channels
Source: Author`s data from the questionnaire survey.

The categories of product purchased online in our survey varied a lot (Fig. 2). There was a relatively high demand for organic food (18.1%); medicinal food or food supplements (12.3%) and similar shares for delicacies (8.5%) and confectionery (7.7%). Among the

consumers` preferences were also products from animal origin, e.g. dairy and meat (6.2%), honey and bee products as well (5.5%) with a very small share for fresh fruits and vegetables (2.6%). Here we have to emphasize that the national agri-food sector is key to the Bulgarian economy, accounting for about 20% of industrial output (Kirechev & Petev, 2021) [24] with the following structure of the agri-food sub-sectors: the largest production for bread, bakery and confectionery and meat processing, which account for over 10% of final output, followed by dairy and fruit and vegetable production. This structure could explain the distribution of preferences among our respondents whose types of online purchased food followed the same pattern. In comparison, Dudek & Śpiewak (2022) [12] argued that the population diet affected by the Covid-19-epidemic changed towards less use of meat and inclusion of more grain products and easily stored goods with long expiration date. Karunarathna et al. (2022) [23] also reported that consumers have placed a premium on foods with a lengthy shelf life, such as canned meals, pasta, milk, while Cranfield (2020) [9] saw a rise in demand for ingredients used in baking perhaps due to people seeking self-sufficiency in light of the pandemic (i.e., in-sourcing the preparation of what usually is bought in a prepared form). Similarly, to our respondents` preferences for delicacies and confectionery, Limon (2021) [28] reported that products sold in great numbers through online channels were mainly baked goods and desserts, followed by savoury snacks, meat, poultry and seafood dishes. On the contrary, Wang & Somogyi (2018) [46] found that the main preferences for e-shopping were for imported food and snack with a weaker interest in fresh products like vegetables, meat, eggs. On the other hand, differences among consumers` choices of online-sold food was found to be influenced by their desire to eat better meals and keep healthier diet (Dawson & Golijani-Moghaddam, 2020; Snuggs & McGregor, 2021) [10, 40] thus turning towards natural food items that provide nutritious, such as whole grains, vegetables, fruits, etc. (Aday & Aday, 2020; Lambert et al., 2021) [1, 25], while for our respondents fruits and vegetables accounted less. However, their healthier lifestyle during the epidemic was maintained to some extent through purchasing of medicinal foods and food supplements ($t[468]= 31.315$, $p=0.000$). The attitude toward healthier diet was extended further through the purchase of organic products by our respondents. The consumers` desire for "better" food is based on the perceived understanding that organic farming and production is a more sustainable system delivering better-tasting, healthier and safer food than that produced by non-organic methods (Wright & McCrea, 2007; Qi et al., 2020; Chaturvedi et al., 2021) [47, 34, 8]. Our respondents` preferences for organic products could be also explained with the growing public awareness on the ‘‘Farm to Fork Strategy” of the European Commission that endorsed organic farming systems for a fair, healthy and environmentally friendly food system (Prache et al., 2022) [33].

## CONCLUSIONS

Food security is a global concern due to the disruption in its four dimensions (availability, access, utilization, stability) after the Covid-19 outbreak in many developed and developing countries and its consequences for the agri-food sector. The study focused on the stage of food availability through innovative approaches like online food shopping, resulting in a profound transformation in the food system. The respondents were accustomed to several types of online channels for buying a diverse range of raw, processed and fresh products. The stimuli behind the online purchasing intentions were strongly influenced by the Covid-19 epidemic, mainly for personal convenience but also for safety issues and desire for healthier and green diet.

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# SYSTEMS FOR THE DEVELOPMENT OF THE GOAT REARING SECTOR FOR MILK PRODUCTION

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***Abstract***

*Along with the increase in the number of animals, the number of animal farms specialized in the production of goat milk also increased, the number of farms equipped with mechanized milking systems, milk pasteurization lines, pasteurized milk bottling, combined slaughterhouses, etc. increased. The aim of the paper is to demonstrate sustainable development as one of the current requirements of the economic efficiency of livestock farms, by ensuring the complete value chain with complex and perfect inputs. The methods of observation, monograph and comparison were used in the elaboration of this work. The data presented in the respective work were accumulated from the statistical researches of the husbandry entities in the country, the official data of the National Bureau of Statistics of Moldova and from the dedicated works on this topic. The results pursued in this research point to the identification of the economic capacities of the goat breeding sector in the Republic of Moldova by making investments in the dimension of increasing the gross added value of the business. The research conclusions allow us to state the availability of reserves by tracking the quality and quantity of production determined by increasing the contribution to the value of production.*

***Keywords*****:** *goat sector, profitability, commodity production, efficiency, breeds, fodder, processing*

## INTRODUCTION

Despite being not as popular as cow's milk, goat's milk has different benefits and nutritional values that cow's milk has. In the recent past, the breeding of goats for milk has become a widespread economic activity, and many other farmers engage in this activity to sustain their existence. The advantages of raising goats over cows are that they are cheaper to maintain themselves and require less space compared to cows. Goats are mostly bred by low-income or middle-income individuals, and therefore bear the name of "poor cow". Although researchers claim that goat's milk contains large amounts of saturated fat that would lead to a rapid increase in body weight, the other benefits of goat's milk make it a product worthy of consumption. The world's largest milk producers are India (5 million metric tons), Bangladesh (2 616 thousand metric tons), Sudan (1,532 thousand tons metrics) andPakistan (801 thousand tons metrics) (Baltag, Rurac and Caisîn, 2021) [3].
In the Republic of Moldova, the goat sector is the only one of those of the livestock branch that registers positive increases of livestock. In the other sectors of the branch, the livestock shrinks and generally has a negative impact on the development of livestock yields. In this context, the purpose of the paper is to analyze sectoral development capacities in the context of business models inspired by current consumer requirements and increasing economic efficiency.

## MATERIALS AND METHODS

The importance of this work is relevant through the applied research methods. The main analysis methods used were the monographic, descriptive and the factor decomposition method. Statistical data related to sectoral development from the sources of the National Bureau of Statistics of the Republic of Moldova were used to develop

the research. The developed materials serve as methodological support for startups in the fields of Moldovan animal husbandry businesses.

## RESULTS AND DISCUSSIONS

The number of goats in the period 2018-2021 decreased due to the economic situation in the country and region, including pandemic restrictions. In the period 2010-2011 we find that the livestock has increased by about 30 thousand heads. This trend has been continuing over the last 30 years. In 1990 the number of goats was only 32 thousand (Table 1) and by 2000 the number of goats increased to 100 thousand.

Table 1. The dynamics of goat herd in the Republic of Moldova, thousands heads

| Category | 1990 | 2000 | 2010 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|
| Agriculture enterprises | 0.0 | 0.0 | 0.4 | 1.4 | 1.3 | 1.4 | 1.2 | 2.7 |
| Households of the population | 32.0 | 100.0 | 110.8 | 161.2 | 154.0 | 143.8 | 140.8 | 137.2 |
| All categories | 32.0 | 100.0 | 111.2 | 162.6 | 155.3 | 145.2 | 142.0 | 139.9 |

Source: author's calculations based on the data from National Bureau of Statistics [6].

In relation to the categories of entities, most of the animals were in households, only by 2010 we see the first registrations of goats in corporate agricultural entities. Thus, the evolution of the development of the goat breeding sector began in households and later, in economic evolution, it passed into the corporate one. The number of milking goats in the year 107.3 thousand heads. Traditionally, the sectors of the livestock branch were based on entities of a collective type from the Soviet period and later passed into the households near the house, which is not characteristic for the goat sector. The development of goat breeding farms in households is the basis of the current economic features of the business model. Most of the farms are of the family type, where the work is provided manually, and as employees are family members.

The consumption of goat's milk in the Republic of Moldova, according to National Bureau of Statistics of the Republic of Moldova, is increasing. The country population consumes goat's milk for its curative qualities. Along with this feature, dairy products are present in the daily food ration of the population. With the reduction of livestock of cows and sheep on farms, the production of goat's milk remains the one accessible from the point of view of location. According to our calculations goat milk production in the year 2022 accounted for 53,635 liters (Table 2).

Table 2. Dynamics of goat's milk yield in the Republic of Moldova, liters

| Milk yield, thousands liters | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|
| All categories | 62,338 | 59,539 | 55,667 | 54,440 | 53,635 |
| Households of the population | 537 | 498 | 537 | 460 | 1,035 |
| Agriculture enterprises | 61,801 | 59,041 | 55,130 | 53,980 | 52,600 |

Source: author's calculations based on the data from National Bureau of Statistics [6].

Of the total volume of milk about 93% are from sources obtained in households. This demonstrates a high degree of concentration of livestock in the household sector. Such a high rate of production from those sources implies insufficient state intervention in the development of the sector. It has a number of drawbacks. Most of the goat farms of households are located in the built-up area of the town halls. Milk production is used for

current consumption both fresh and processed in the form of cheese. The degree of investment in these farms is rudimentary and insufficient. Animal productivity is reduced due to reduced genetic material. All these peculiarities disadvantage the development of the sector (Wilson, 2018)[10].

Under these conditions, part of the country's population prefers the consumption of goat's milk. Consumers of goat's milk prefer to consume fresh, especially those from the countryside, or in the form of cheeses.

Currently, cheeses, cheeses and other derivatives from milk production are sold on the shelves of super-market stores. The milk production of goats is also marketed on social networks in a rather intense way. This trend is observed from discussions with milk consumers. The rural population appreciates milk for its taste and health-regenerative qualities. This year, according to data from the National Bureau of Statistics, it is estimated that the average milk consumption in the calculation per person will increase from 14.5 to 14.9 liters. This consumption is provided from both internal and external sources. Goat farms in the country provide an average production of 12 liters per capita, the other 3 liters are insured on account of imported production (Table 3).

Table 3. Quantity of milk production imported into the Republic of Moldova

| **Indicator** | **2019** | **2020** | **2021** |
|---|---|---|---|
| Quantity, tonnes | 2,433 | 2,680 | 3,459 |
| Value, thousands of dollars$ | 9,624 | 10,899 | 14,750 |
| Average price per ton, thousand dollars$ | 3.96 | 4.07 | 4.26 |

Source: author's calculations based on the data from National Bureau of Statistics [6].

Goat's milk is consumed mainly in the form of cheese and cheeses. Most of the exported productions refer to the production of cheeses, which are sold in super-market stores. Goat milk is sold at an average price of 12-17 lei per liter. For processing milk is purchased at a price of 8-9 lei per liter. At the same time, goat cheese is also purchased on the market, which enjoys a stable demand. In 2021, the quantity of goat cheese produced by all categories of households in the country was about 4,827 tons (Table 4).

Table 4. Production and valorisation of goat cheeses in the Republic of Moldova

| **Indicator** | **2020** | **2021** | **2022** |
|---|---|---|---|
| Quantity, tonnes | 5,010 | 4,900 | 4,827 |
| Value, thousands lei | 445,893 | 445,866 | 448,926 |

Source: author's calculations based on the data from National Bureau of Statistics [6].

The potential of the local cheese petition is estimated at about 450 thousand lei. The price of one kg of cheese varies from 120 to 140 lei per kg at agricultural markets and shops. The wholesale price of cheese is estimated at 95-100 lei per kg. The cheese shall be sold at retail and wholesale. Retail sells farmers who sell their wares at stalls in agricultural markets.

Most of the farmers who market their own products at the agricultural markets additionally employ one person for sale, incur the costs of transporting the goods, packing costs and certification. The sense of marketing of retail products reveals from the higher price. Thus, farmers who manage to secure their marketing process through agricultural markets increase the profitability of their traded goods. Participation in various exhibitions with its own production increases the visibility of the company and revenues. During the exhibitions, visitors get acquainted with the exhibited production, taste the food products, thus becoming known the respective production.

Investment research is carried out based on milk production in relation to the goat breed. The research is aimed at exploiting the Saanen breed. This breed is of Swiss origin, has a waist of 80-90 cm in males and 74 -80 cm in

females, elongated body, suitable long and wide head with almost straight profile, deep chest, wide chest with good chest capacity, wide and tightly fastened back, long and relatively thin neck and with earrings under the jaw with resistant ongloans, Well developed udder with medium nipples tilted laterally and forward, and the hair is short, dense and silky.

The Saanen breed can be used with good crossbreeding results, with the Carpathian breed. The average weight is 65 kg, prolificacy – 2-3 kids per goat, the average annual productivity – 800 liters/goat and the maximum productivity – 1,800 liters per goat.

The total number of milking goats will be 300 heads.

The livestock on a holding shall be determined on the basis of the investment capacities, on the one hand, and the profit sought.

The capitalization of the research also results from the current policies of the Government in relation to the development of agriculture. According to the National Strategy for Agricultural and Rural Development for the period 2023-2030 [7], it is planned to stimulate the opening of about 120 goat farms throughout the country. Each farm must have at least 250 milking animals on the farm.

This policy is in line with the revitalization of the sheep and goat breeding sector in the country.

Our guidance is apparent from those reasonings in agricultural policies.

Based on goat herds at farm level, we are still determining the production capacities of the research. The calculations were made based on the current production rules, the average annual milk productivity, the transfer coefficients of the processed production.

The areas required for the farm and the rooms for processing, the slaughterhouse, etc., were determined on the basis of the veterinary rules for the maintenance of a goat and those for compliance with the veterinary requirements for the primary processing of production.

Based on the data from Table 5, we determine the capacities of the production of pasteurized milk and other dairy products. The productions will be obtained within the entity, with the availability of purchasing the respective equipment.

Table 5. Estimated production capacities of the farm with a herd of 300 goats

| Indicator | Values |
|---|---|
| The average annual amount of milk, liters | 240,000 |
| Average annual number of live products | 525 |
| Average annual number of hides and skins obtained | 499 |
| Average annual quantity of slaughtered meat, kg | 4,909 |
| Average annual quantity of manure, tonnes | 200 |

Source: author's calculations based on the data from National Bureau of Statistics [6].

Table 6. Capacities of dairy products obtained on the goat farm

| Product types | Milk, l | Product, kg |
|---|---|---|
| Pasteurized milk | 96,000 | 93,120 |
| Salted cheese | 120,000 | 10,000 |
| Sweet cheese | 24,000 | 2,400 |

Source: author's calculations based on the data from National Bureau of Statistics [6].

Based on the production norms, in Table 6 we present the processed productions that will be obtained within the livestock farm.

Of the average annual quantity of milk to be recovered, 40% of the production will be marketed in the form of pasteurized milk, 50% in the form of cheese and 10% in the form of fresh curd.

Such a structure is quite rational, thus it will ensure the diversification of sources of income, goat cheese and pasteurized milk being basic.

Table 7. Area of land sown and forecasted harvest

| Culture | Surface, ha | Yield, kg |
|---|---|---|
| Corn grains | 3.6 | 23,400 |
| Peas | 4.5 | 18,000 |
| Autumn wheat | 6 | 22,800 |
| Barley | 5.4 | 17,280 |
| Lucerne | 6 | 90,000 |
| Oats | 4.5 | 13,500 |

Source: author's calculations based on the data from National Bureau of Statistics [6].

Production capacities also refer to the land resources of research. As mentioned above, the management of 30 ha of arable land is planned to provide its own forage base. For

the first year of activity, a structure of 5 soles is proposed (Table 7).

On that area, crops are to be sown, the production of which will be used in the food ration of goats. Part of the harvested production, the surplus, will be marketed. In this respect, we mention that the existence of its own feed base contributes significantly to the reduction of operational risk in relation to the evolution of prices on the feed market (Parliament of the Republic of Moldova, 2017) [8].

The availability of ownland demonstrates a sufficient level of assurance with its own forage base. Also, harvested crop production can also be a source of additional income along with basic production (Table 8).

Table 8. Required quantities of own feedingstuffs for the maintenance of animals in average annual consumption

| Forage type | Internal consumption | Own production | Degree of insurance, % |
|---|---|---|---|
| Corn grains | 20,756 | 23,400 | 113% |
| Peas | 16,605 | 18,000 | 108% |
| Autumn wheat | 14,945 | 22,800 | 153% |
| Barley | 16,605 | 17,280 | 104% |
| Lucerne | 55,627 | 90,000 | 162% |
| Oats | 14,114 | 13,500 | 96% |
| Weighted average, % | 123% | | |

Source: author's calculations based on the data from National Bureau of Statistics [6].

The calculations in the table above demonstrate that the volume of production for internal consumption on most crops grown in the first year of activity is lower than the harvest obtained (own production). Thus, the average degree of insurance of goats' food ration from domestic sources is about 123%. The largest surplus is recorded in the production of alfalfa, which is slightly a product with high demand. Through these calculations we demonstrate the efficiency of investment research with the management of agricultural land. The availability of agricultural land must become a business principle in the livestock branch. Agricultural land ensures the prevention of risks as a result of climate change (heat, frosts, etc.). For this purpose, breeders of large animals, cattle, pigs, goat sheep, etc. should be directed. According to scientific norms, one hectare of agricultural land provides with feed 7-9 goats or sheep. In our case the ratio is 1:10.

Carrying out the structuring of the sown areas gives the opportunity to the entrepreneur to model according to the capacities the cultivation of basic feed individually. We cannot say with certainty that the structure presented in Table 8 is the most rational, but the availability of such a model contributes to a good exploitation of agricultural land on livestock farms. This method is recommended as a methodological title for all those interested in business development in the livestock branch.

The production capabilities of an investment project require a multilateral approach. The development of a business in agriculture today can take place through a consistent and sustainable approach. The accomplishment of technological and economic tasks by the entrepreneur in relation to investment research can take place by identifying viable solutions for trade, production and acquisition. Determining and planning actions in this context is absolutely necessary. The development of investment research must be approached in the complex, by consolidating actions and strengthening products according to supply and demand. Thus, investment research provides for the diversification of income, the use of auxiliary production as additional income, the exploitation of manure as organic fertilizers, etc.

Operational costs are the items of consumption of materials, services and labor used in the production process. In the investment research, the costs were deducted according to the materials and resources consumed during the operational period. The prices for the materials and resources consumed are presented on 01/07/2022. The purchased materials are necessary to ensure the development of the processes of initiation of the livestock farm.

In this context, we determine the costs of production carried out in the context of the marketing of production on the domestic market. Factors of influence of the necessary

elements are provided by the main indicators of development.

Investment research is organized to process production in full. The production to be determined in order to succeed in carrying out the processing procedures in full. For this, in the project we present the costs of production related to the production process (Table 9).

Table 9. Production cost items

| Types of production | Total, lei |
|---|---|
| 1. Milk | 864,000 |
| 2. Piei | 200 |
| 3. Meat | 122,719 |
| 4. Agriculture | 170,094 |
| 5. Corn | 35,100 |
| 6. Peas | 23,400 |
| 7. Wheat | 36,480 |
| 8. Barley | 22,464 |
| 9. Lucerne | 37,800 |
| 10. Oats | 14,850 |
| 11. Pasteurized milk | 297,984 |
| 12. Salted cheese | 326,000 |
| 13. Sweet cheese | 46,320 |
| 14. Total costs of processed production | 670,304 |
| 15. Exceptional costs | 18,273 |
| **Farm's costs** | **1,845,589** |

Source: author's calculations based on the data from National Bureau of Statistics [6].

The following elements shall be included in the costs of production:

-Costs related to the remuneration of work;

-Feed costs;

-Costs for zoo-veterinary products;

-Costs of mechanized works;

-Other exceptional costs and costs (Baltag and Popescu, 2018)[2].

The systematized costs are the totality of the entity's costs related to the operational process of the research.

The costs presented refer to the period of one year. Thus, for the first activity, based on the investments made and the planned productions, it reaches the level of about 1.8 million lei. The value of the costs results from the tariffs executed for the current year, the productivity of the work, the level of remuneration, the prices of inputs, etc. Another side of the operational activity of the enterprise relates to the investment expenses.

The expenses include materials and resources that do not directly participate in the production process. The reference period for expenditure shall relate to the financial year. In the investment research, there were provided expenses necessary for the management activity, such as secretarial, travel, etc.

General and administrative expenses are the assurance of the activities of administrative staff in relation to the external environment of the entity. Communication and development of the enterprise is vitally necessary for the project. Thus, the stringent actions related to the forecasted expenditures were forecasted. Their value in the current year is forecasted at the level of 39.5 thousand lei.

The basic element in capitalizing on the results of the operational activity of the research is the sales revenues. Revenue is the total value of marketed productions and relates to a unit of time, usually one year of activity. Sales revenue is the product of the volume of marketed production and the price for the realization of a unit. In this way, when determining the revenues from the marketing of production of investment research, current prices on the domestic market, including retail ones, were taken into account. According to the research, it is expected that the investment will be made by marketing the production at the local agricultural markets, including the district ones. The sale of animal production in agricultural markets is regulated by the Law no.257/2006 on the organization and functioning of markets for agricultural and agro-food products (Ministerul Economiei, 2006) [5] and others.

The modern algorithm related to the evaluation of investment projects is based on the methodological guide "Methodology of elaboration and evaluation of investment projects for the agro-food sector and the practical guide "Investments in agricultural business", author Stratan A. and Bajura T. [9].

According to the respective sources, the market value of an investment object, as well as the efficiency of making investments as such, must be calculated on the basis of net cash flows (Net Cash Flow – NCF), insured through the respective investment activity.

Obviously, both cash inflow flows and cash outflow flows must be taken into account.

It is necessary to mention that any investment activity can be carried out both in the conditions of the "inflationary" economy, as well as the "deflationary" one, and, even, in the conditions of the economy with the so-called "zero - inflation", which, as a rule, is in the middle, usually – a relatively short period of time and which still has to be taken into account (Baltag, 2020)[1].

The economic specificity of the period of "zero - inflation" of a national economy is the fact that it maintains during this period, both the stable purchasing capacity of money and the absolute stability of prices, as such.

Being ascertained the fact of the functioning of the national economy under the conditions of "zero - inflation", all cash flows (both cash inflows and outflows) can be taken into account in their absolute sizes (without any change in order to adapt them to market conditions).

As the main indicator in terms of establishing the economic effect of investments made under the (even imaginable) conditions of the economy with "zero - inflation" serves the term of recovery of investments (Tp.p.), which is identified by the formula:

$$\boldsymbol{Tp.p.} = \frac{\mathbf{IC}}{\mathbf{Pm.a.}} (\boldsymbol{ani}) \qquad \text{……..(1)}$$

where:

IC – initial cost, lei;

Pm.a. – profit,insured by the exploitation of the respective investment object, lei/year.

But this formula occurs to be in the case when the annual profit is constant throughout the duration of the investment research.

However, if the profit (NET income) is not equal over time, then the sum of the profits per period will be used:

$$\boldsymbol{Tp.p} = \boldsymbol{IC} - \sum_{h=1}^{T} \boldsymbol{Phi} \qquad \text{….(2)}$$

In the case of the analyzed investment research, the size of the profit is not evenly distributed throughout the duration of the investment research and for a clearer convenience it can be represented graphically (Figure 1).

The size of the cash flow of the investment research demonstrates the return on investment for the 7th year of activity. Towards this period the development of the farm must be ensured. During the recovery period, in parallel, the goat-breeding farm must develop in terms of a permanent investment process.

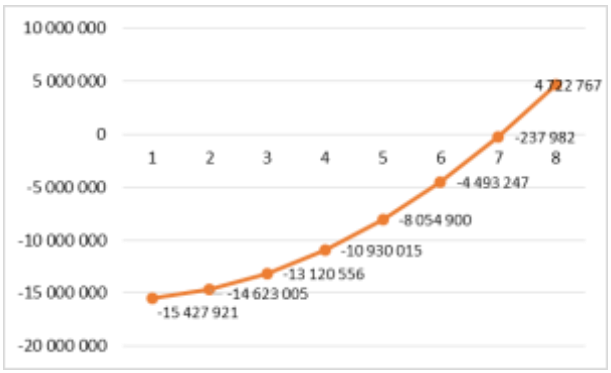


Fig. 1. Recovery period (years) in relation to the amount of cash flow (Lei)
Source: Own design.

This envisages improving the geno-fund of animals, replacing the basic farm with young animals, maintaining the quality of production and increasing promotion actions, etc. The realization of current and operational investments will result in the entity's net profit. Being a basic indicator in terms of evaluating investment research, the size of Tp.p., however, does not inform us at what cost we obtain this result. It is only not excluded that other (alternative) projects may achieve the same result with lower expenditure in the form of initial investments (Baltag and Baranov, 2013)[4].

In order to overcome these deficiencies, along with the Tp.p. indicator, the Accounting Rate of Return (ARR) must also be calculated, which is calculated according to the formula:

$$ARR = \frac{\text{AAP}}{\text{IC}} \times 100\% = \frac{4\,312\,798}{15\,427\,921} \times 100\% = 28{,}0\% \qquad (3)$$

where:

AAP –average annual profit.

IC – initial cost.

That value (28%) proves that for each leu of investment, the average annual profit will be about 28 bani. Such a result can be qualified

quite good and adjustable for investment activity in such a field of activity.

As a rule, this indicator can be compared with the average annual interest rate of bank deposits, and in the case when its size exceeds the average size of bank deposits for legal entities the investment is considered efficient and rational. On 15/09/2022, the average interest rate for deposits of legal entities is at the level of 12.5% annually. Therefore, the coefficient of investment effectiveness in the amount of 28% is much more rational. Thus, the investor becomes interested in the given investment compared to the placement of the financial resources on the deposit.

Within an inflationary economy there are several phenomena that make it important to have an amount of money that is available as more valuable compared to the same amount of money but over a period of time. Taking into account the phenomenon of inflation (in a popular aspect – the phenomenon of devaluation of money over time), the results of the exploitation of investment objects (income or gross receipts), must be sufficient not only to cover current expenses (variable and fixed), but also the level of devaluation of money over time, or the possibility of investment research to compete with other projects, as an example of depositing the available financial resources on a bank deposit that offers a any interest rate or opt for another, more attractive investment project or with lower risks.

Therefore, in the conditions of the inflationary economy, it is not the absolute amounts of receipts with the volume of investments that are compared, but the updated amounts of revenues, that is , the amounts without the effect of inflation.

The present amount of net cash fluctuations (Net Cash Flow), being at the same time the current (present) market value of the investment object at the stage of putting it into operation in the future time, is called the present value of the investment research (Present Value – PV) and is calculated according to the formula:

$$PV = \sum_{n=1}^{n} \frac{P_n}{(1+r)^n} \qquad (4)$$

where:

$P_1$; $P_2$; $P_3$ … $P_n$ –Net Cash Flow, MDL;

r –discount rate – embodies in itself several factors such as: 22% - the cost of capital invested, 4% - estimated profit, 2% - the risk premium (risks that have not been taken into account but may occur).

n –the number of calculation periods (in our case – the number of years since the establishment of the investment research n = 11).

Being calculated on the basis of future cash receipts, the present value (present value) is a basic criterion for deciding on whether to make investments in the respective investment research. Based on the calculation of the previous data, the present value of the research given to the investment:

$$\text{PV} = \sum_{n=1}^{11} \frac{32\,012\,854}{(1+0{,}28)^{12}} = 52\,251\,130{,}06 \text{ lei} \qquad (5)$$

We emphasize once again that at the initial stage of exploitation of the investment object, its present value, which also constitutes the market price of this object, is equal to MDL 52,251,130.06 (if for the entire exploitation period the discount rate will be constant, amounting to 28% annually).

Along with the market price for investors it is important to know the comparison of PV with IC. As a consequence, another important indicator appears, called – net present value (NPV). It should be emphasized that any investment project, being evaluated in advance by the investor, should not have its market price lower than the initial cost of the investment (StratanAlexandru, Bajura Tudor, 2017)[9].

So, any investment project will be accepted by the investor if PV >IC and will not be accepted in case PV<IC. For investment research of a super intensive apple orchard the size of the NPV is equal:

$$NPV = \sum_{n=1}^{n} \frac{P_n}{(1+r)^n} - IC = 29\,105\,028{,}78\ lei$$

We therefore come to the conclusion that PV (Present Value) exceeds IC (Investment

Costs) and NVP (Net Present Value) as a value significantly exceeds zero at a discount rate of 28%. For these reasons, the research can be accepted by potential investors.
Although the discount rate selected by the authors (28%) is a relatively high one, because it includes in itself several aspects, such as inflation, possible risks, etc., the term of repayment of the investment is 7 years.

## CONCLUSIONS

The proposed investment research appreciates the approach of goat milk production with the processing of dairy products in the agricultural farm by ensuring the level of quality self-control.
-The general approach to research demonstrates that a business in the production and processing of livestock production can be profitable under the conditions of a sufficient investment level and a degree of complete insurance with means of production;
-The research provided from a technical and technological point of view, such as the one presented, ensures a recovery period of about 7 years;
-Investment research is a technological and business guidance for all those interested in start-ups of this kind;
-Through the calculations offered, the research offers the opportunity to conduct a business in the field with the subsequent processing of the obtained animal productions;
-The research is carried out based on the provision of the feed base from own sources, managing agricultural land, which increases its profitability index;
-The profitability of production in the first activity is about 30%;
-The recovery of the invested capital attracted from internal sources for the financing of the given research constitutes 13.5%;
-The market price of this object is 52,251,130.06 lei;
-The demand for goat's milk production in the Republic of Moldova is increasing, the market of this segment is in formation;
-About 50 intensive-type farms, according to the standard research, would provide about 12 million liters of goat's milk, which would completely cover the level of internal consumption of production in the Republic of Moldova.

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# UNCOVENTIONAL FOOD PLANTS: RICH NUTRIENTS SOURCES WITH UNTAPPED POTENTIAL - A LITERATURE REVIEW AND A CLOSE EXAMINATION OF THE ROMANIAN LEGISLATION IN THIS REGARD

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***Abstract***

*The difficulty of finding non-animal protein sources has determined scholars to explore the less researched plants in recent decades. Alternative protein sources, such as those derived from multicellular fungus, microalgae, and unconventional vegetables, have become a prominent focus in Western studies, particularly because urbanization and distance from metropolitan centres might limit access to food plant resources. Plant-based proteins are regarded an economical option and can be derived from industrial waste, which is abundant and has significant health benefits. The present article aims at exploring the potential of unconventional food plants, as although not much attention is dedicated to them throughout the public food chains, they have gained much academic interest in the last 10 years. Particularly, their potential in Europe, as well as in Romania is the focus of this paper. In Romania, while the current legislation recognizes their existence, their understanding is limited to that of genetically modified organisms. The implications of this lack of understanding are outlined in the final part of this paper.*

***Key words*****:** *unconventional food plants, importance, characteristics, legislation, Romania*

## INTRODUCTION

Non conventional food plants are innovative food products containing new ingredients, capable of meeting nutritional needs and new consumption trends.

Firstly, different species of plants, called non-conventional food plants, are studied in the literature and can provide food with a better composition, and can be healthier.

Secondly, more than this, non-conventional food plants are addressed to economically disadvantaged people being an alternative income source in the family.

Thirdly, non-conventional food plants do not need pesticides giving a help to environment avoiding pollution of soil air, and water.

Last but not least, from a biological point of view, these plants are resistant to drought, and could be easily cultivated with very low costs.

However, they are not known so much by the majority of the population.

Usually, these plants are closely connected to the traditional agricultural practices and cultures in various countries (Gaban and Borges, 2020) [12].

Several plant-based food products have been identified as innovative, including *Moringa oleifera*, *Pereskia aculeata Miller*, *Jatropha curcas L.*, *Bambusa vulgaris*, and *Gramineae bambusoideae*. These plants are recognized for their high nutritional value, particularly in terms of fiber, protein, phenolic compounds, and carotenoids. In addition, there are other unconventional edible plants such as white acacia (Saucedo-Pompa et al., 2018) [24], *Ora-pro-nobis* (Agostini-Costa, 2020; Garcia et al, 2019) [1, 13], *Jatropha* (León-Villanueva et al., 2018) [18], and bamboo (Kong et al., 2020; Nongdam & Tikendra, 2014; Wang & Ng, 2033) [16, 19, 30], which

can be used in food processing and protein extraction.

This group of less studied plants until recently has captured the interest of the academic community by virtue of the debates regarding the identification of new sources of proteins, of non-animal origin (Felix et al, 2016) [11].

In the current scenario, the focus on finding alternative sources of protein has gained prominence in Western research, owing to factors such as urbanization and limited access to food plant resources. To address this concern, unconventional vegetable sources (Akyüz & Ersus, 2021; Cho et al., 2020; Silva et al., 2019; Wang et al., 2020) [2, 8, 26, 31] and protein sources from multicellular fungi (Colosimo et al., 2020) [10] and microalgae (Callejo-López et al., 2020) [6] have been explored. The knowledge and use of these sources may be limited by factors such as urbanization and access to food plant resources, as highlighted by previous studies (Benz et al., 2000) [4]. Plant-based proteins are considered an economic substitute and can be obtained from industrial wastes, which are prolific and with important benefits to human health (Call et al, 2020; Girgih et al, 2013; Sá et al., 2020) [5, 14, 23].

It is estimated that, in 2054, approximately 1/3 of all protein consumed will be of vegetable origin (Henchion et al., 2017) [15].

The generic names used for these are alternative food plants, wild edible plants, unconventional vegetables or 'plants of the future' (Leal et al, 2018) [17]. According to Kinupp and Lorenzi (2014, as cited in Cobus et al., 2023) [8], the terminology used to describe food plants is limited and tends to refer to a narrow category of plants, such as "wild vegetables," which can lead to confusion. To address this issue, they suggest using the term "unconventional food plants," which includes plants that are not commonly used for food, often require unusual preparation methods, and are typically undervalued in the market or traded on a small scale. This broad definition refers to both native and exotic plants, including cultivated and naturally occurring plants (Cobus et al, 2023) [9].

In this context, the purpose of the paper is to present a review on the potential of unconventional food plants exiting especially in Europe, as well as in Romania and to stress their importance in human life and health, as well as its economic and environmental benefits.

## MATERIALS AND METHODS

In order to investigate the characteristics if unconventional food plants, we look at studies published within the last decades by means of a qualitative content analysis, as well as taking into consideration the Romanian regulations, as well as tradition in regards to unconventional food plants. This study is consistently relevant in the context of the global search for non-animal protein sources, as well as non-chemical medicine alternatives.

## RESULTS AND DISCUSSIONS

In general, research in recent years has shown that non-conventional plants have great potential in various fields and that there is an increase in interest in their use. However, there are still many aspects that need to be explored and researched in detail to better understand the impact and potential of these plants in different fields.

Several scholars have observed a decline in plant knowledge among communities residing close to urban centers as compared to those in isolated areas, which they attribute to the process of delocalization. Pelto and Pelto (1983) [20] have defined delocalization as the expanding network of socio-economic and political interdependencies that influence people's diets, leading them to rely more on food and products sourced from distant locations via various commercial channels. Concurrently, recent literature has highlighted another process that underscores the growing significance of urban forests and wild edibles in urban areas in contemporary diets (Poe et al., 2013; Shackleton et al., 2017) [22, 25].

Several studies conducted in different regions have shown that many wild plants have both nutritional and medicinal uses. For instance, Pinela et al. (2017) [21] found that 33 out of

37 wild plant species in Northern Portugal were used for medicinal purposes in addition to food. Yang et al. (2020) [32] reported the use of 19 out of 75 plant species for both medicinal and nutritional purposes.

In Southeastern Angola, Urso et al. (2016) [29] found that about 11% of the known plants in the communities they studied were consumed as both food and medicine. For example, the fruit of *Aframomum alboviolaceum* was used as an anthelmintic and also eaten raw. Such species can be investigated for their potential nutritional and medicinal benefits. The potential therapeutic benefits of underutilized wild edible species, which have been traditionally used for both food and medicinal purposes, is a topic of interest, as highlighted by Towns and Andel (2016) [28]. Localized studies on unconventional food plants are essential to document species that hold traditional use value and to encourage their cultural use and conservation, especially in communities undergoing socio-economic changes resulting from proximity to urban areas. For example, Campos et al. (2016) [7] reported that the species *Hancornia speciosa* Gomes (Apocynaceae) is consumed exclusively as food, while the latex derived from the stem is used for medicinal purposes to treat and prevent gastrointestinal problems. The participants of the study revealed that although green fruits with latex were used as medicine in the past, the higher concentration of latex in the stem led consumers to preferentially use this part for medicinal purposes.

The prevalence of non-conventional food plants in Europe varies by region and country. Some of these herbs have a long history of use in traditional cuisines, while others have been added more recently to the diet of European countries. In general, countries with a stronger culinary tradition tend to have a greater diversity of unconventional food plants available.

Nordic countries such as Sweden, Finland and Norway have a long history of foraging wild foods, including berries, mushrooms and wild herbs. These countries also have a growing interest in more exotic and unconventional foods, seaweed, insect-based foods and other plant-based alternatives to meat and dairy.

In Mediterranean countries such as Italy, Spain and Greece, there is a rich tradition of using wild greens and herbs in food, such as dandelion greens, wild fennel and butterwort (*Portulaca oleracea*). Other unconventional food plants gaining popularity in Europe are chia seeds, quinoa and amaranth, which are all native to South America but are now grown in several European countries.

Research by Takahashi et al (2020) [27] found that wild food plants are commonly used for food and medicinal purposes in rural areas across Europe. The study identified a total of 377 plant species from 45 families that are used as food and medicine in 26 European countries.

In Romania, there is a long tradition of using wild plants in traditional medicine and traditional cuisine.

Some of the more popular wild plants used in food are nettles, dandelion, wild spinach, sedge, mouse tail, burdock, wild mustard, blueberry, wild raspberry and strawberry. These herbs are used in salads, soups, sauces and other dishes.

Regarding the use of wild plants in medicine, in Romania there is a long tradition of using them to treat ailments such as colds, coughs, flu, headaches, digestion and many others. Some of the most widely used wild plants in Romanian traditional medicine are chamomile, horsetail, St. John's wort, calendula, mint, basil, licorice, lime and sage.

However, the use of wild plants should be done with caution, as some plants can be toxic or have side effects. It is also not recommended to collect plants from polluted areas and not to consume plants whose provenance is unknown. In Romania, non-conventional plants fall under the scope of Law no. 321/2009 regarding the cultivation of genetically modified plants and plants intended for industrial use, which was updated by Emergency Ordinance no. 107/2019 on the regulation of certain measures in the field of genetically modified organisms and non-conventional plants.

According to this law, non-conventional plants are defined as plants that are not part of

the traditional species commonly cultivated in the European Union and that are not listed in Annex I of Regulation (EC) no. 1829/2003 on genetically modified food and feeds.

The law states that the cultivation of non-conventional plants is allowed only for experimental purposes and only with the consent of the competent authorities. Cultivation of non-conventional plants is also not allowed in protected areas, as well as in water protection areas.

In addition, the law requires that these plants be registered in a national register of non-conventional plants, which contains information on producers, traders and importers of non-conventional plants. The competent authorities have the responsibility to monitor the cultivation and marketing of these plants.

Regarding the use of non-conventional plants in food, they are regulated by national and European food legislation. Before being marketed, non-conventional plants must be evaluated and approved by the European Food Safety Authority (EFSA) in accordance with standardized risk assessment procedures.

From 2000 to 2006, Romania strictly followed the regulatory framework under the agricultural authority for the registration of crop varieties and hybrids, including biotechnological crops. An important administrative step before the introduction on the market of any cultivar or hybrid consists in fulfilling all the requirements imposed by the International Union for the Protection of New Varieties of Plants, a convention to which Romania has been a party since 1961, renewing this cooperation in 2001 (Antofie & Sand -Sava, 2022) [3].

Thus, the introduction to the market of any crop variety or hybrid in Romania falls under the responsibility of the agricultural authority with the support of the State Institute for Testing and Registration of Plant Varieties. This institute operates at the county level as a network of County Centers for testing and registering varieties and hybrids of crops that require them to be globally recognized by standard procedures. Before entering the European Union, there was no biosecurity inspection system to ensure traceability, labeling or monitoring in the field.

The first soybean test (RR S2254RR) in the field took place in 1999. At the same time, GEO 49/2000 entered into force 1 year before the adoption of Directive 2001/18/EC and the National Biosecurity Commission was established, a forum scientific body made up of scientists, researchers and other personalities from public institutions with a major role in decision-making. Based on the agreement made by the National Biosafety Commission, the authorizations for testing genetically modified organisms in the field and for commercialization were approved (Antofie & Sand-Sava, 2022) [3].

Starting from 2010, the Romanian Tree Research and Development Station in Bistrita is the first public institution that continuously applied for testing the genetically modified plum for the Plum-Pox virus (plum blight).

However, in traditional Romanian medicine, many wild plants are used for their therapeutic properties. Dandelion (*Taraxacum officinale*) is used to stimulate digestion and diuresis, as well as for detoxification and purification. Horsetail (*Equisetum arvense*) is used to treat kidney problems, soothe inflammation and stimulate wound healing. St. John's wort (*Hypericum perforatum*) is known for its antidepressant, anti-inflammatory and antibacterial properties. Marigolds (*Calendula officinalis*) is used for their anti-inflammatory, healing and antimicrobial properties, especially for skin conditions. Plantains (*Physalis alkekengi*) is used in the treatment of respiratory problems, inflammations and urinary infections. In traditional Romanian cuisine, wild herbs are used to add flavors and additional nutritional benefits to specific dishes. Some examples include: Leurda (*Allium ursinum*), a wild herb similar to garlic, used in salads, soups, stews and other dishes to add flavor and health benefits, Nettles (*Urtica dioica*) - eaten in soups, pies and other dishes, nettles are rich in vitamins, minerals and antioxidants; Horseradish leaves (*Tussilago farfara*), a traditional version of horseradish using horseradish leaves instead of the classic vine leaves; Sorrel (*Rumex*

*acetosa*) is used to add flavor and nutritional benefits to salads and other dishes.

These plants remain virtually unknown to the academic environment, as well as international practitioners in the field of food supplements, and should be known worldwide. At the same time, the Romanian legislation does not encompass them to the same extent as genetically modified plants, although they are equally less known. This encourages a downplay of local resources, as well as important losses for the Romanian economy, which could monetize them to foreign markets.

## CONCLUSIONS

Recent research has demonstrated that non-conventional plants have significant potential in many industries and are becoming more popular.

Local studies on non-conventional food plants are crucial for recording species with traditional use value and encouraging cultural use and conservation, especially in communities facing socio-economic transformation owing to urbanization.

Non-conventional food plants vary across Europe.

Certain herbs are part of traditional cuisines, while others are not commonly used in European diets. Countries with a well-established culinary culture often incorporate unconventional food plants into their cuisines. In Romania, for example, wild herbs are frequently used in traditional medicine and gastronomy. Common wild foods include nettles, dandelion, wild spinach, sedge, mouse tail, burdock, wild mustard, blueberry, wild raspberry, and strawberry. These herbs are often used in salads, soups, and sauces.

In traditional Romanian medicine, numerous wild plants have healing characteristics. Dandelion (*Taraxacum officinale*) aid digestion, diuresis, and detoxification. Horsetail (*Equisetum arvense*) helps kidneys, inflammation, and wound healing. St. John's wort (*Hypericum perforatum*) has antidepressant, anti-inflammatory, and antibacterial properties. Marigolds (*Calendula officinalis*) have anti-inflammatory, therapeutic, and antibacterial effects, especially for skin disorders. Plantains (*Physalis alkekengi*) treat respiratory, inflammatory, and urinary illnesses. Wild plants give flavor and nutrients to Romanian recipes. Academics and many practitioners are unaware of these plants, which should be known worldwide. To this day, the Romanian legislation does not encompass them in the category of unconventional food plants, although genetically modified plants, for instance, have been recognized as such. This devalues local resources and implies an invisible, but significant cost to the Romanian economy, as they could be sold for many uses and in multiple formulas abroad. Future research should consider their prevalence and use locally, so as to gain more depth into the potential of their commercialization in different areas of Europe, where they are needed.

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# BULGARIAN AGRICULTURAL STRUCTURE AND PROSPECTS POST-2023

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***Abstract***

*The CAP 2013 reform aimed to achieve ambitious goals - more equality in the distribution of financial support, better targeting and „greening" of direct payments. The aim of the study is to outline the changes in Bulgarian agricultural structure and to formulate recommendations for the post-2023 period. The results show that in Bulgaria, during 2010-2020, the number of agricultural holdings decreased by 64%, and the farm structure was seriously transformed. The trends of land concentration and polarization are continuing, although the European and national policy priorities are directed at overcoming the imbalances and differences. These land concentration processes are accompanied by accumulating a significant share of direct payments in large holdings. The transformations in farm structure could lead a significant challenge in the context of future Bulgarian agricultural development, food security and livelihood in rural areas. The flexibility and subsidiarity proposed by the CAP allow the EU Member-states to set their priorities and direct financial support to crucial sectors according to national specifics. However, financial aid should be better targeted, and the capping and payments reduction need to be more efficient.*

***Key words*****:** *farm structure, land concentration, direct payments*

## INTRODUCTION

The development of the Bulgarian agricultural sector in the last thirty years has been going through significant structural transformations. The accession to the EU and the implementation of the CAP are related to political and socio-economic changes in Bulgaria that impact the production, the sectorial and organizational structure of agriculture [3]. The restructuring process generated a number of consequences that affected rural areas' development.

The CAP 2013 reform aimed to achieve ambitious goals - more equality in the distribution of financial support, better targeting and "greening" of direct payments. However, some studies [11, 12, 22, 23] show issues associated with direct payments distribution, converges process, climate change combat and biodiversity maintenance.

In the context of the 2021-2027 programming period and the development of rural areas after 2023, several challenges have to be addressed. The aim of the study is to outline the changes in Bulgarian agricultural structure and formulate recommendations for the post-2023 period. The paper is structured as follows: First, the methodological framework is presented. In the second part, the main trends in farm structure and the dynamic in direct payments allocation is observed. Based on the analysis conclusions and recommendations are outlined.

## MATERIALS AND METHODS

The study is based on data from the Farm structure surveys carried out in all Member States of the EU. The paper applies EUROSTAT common methodology that provides comparable and representative statistics [15]. European Commission reports [7, 8] are used for direct payments distribution.

## RESULTS AND DISCUSSIONS

### Farm structure trends and evolution

The scientific literature defines structural changes as „a complex, multifaceted phenomenon, not only because economic

growth leads to subsequent changes in various sectors of the economy, but also because these changes affect the growth process "[16].

Brinkman and Warley [5] outline the main components that may be affected by structural change. Structural changes in the agricultural sector are often related to the transformation of farms number, the concentration of economic activity and changes in the attitudes, preferences and motives of the farmers [29]. The production factor allocation is considered as key driver for these processes. [17].The structure of agricultural production in the EU has changed seriously since the beginning of the XXI century.

As a result of these structural transformations, the concentration of land in a relatively small number of large farms also increased. Therefore, structural changes also affect resource allocation and financial support, as well as regional development and rural employment, maintenance of rural landscapes, biodiversity and environmental protection [23].

The changes in key structural features are registered. Figure 1 presents the variations in the number of farms and utilized agricultural area (UAA) for the period 2005-2020.

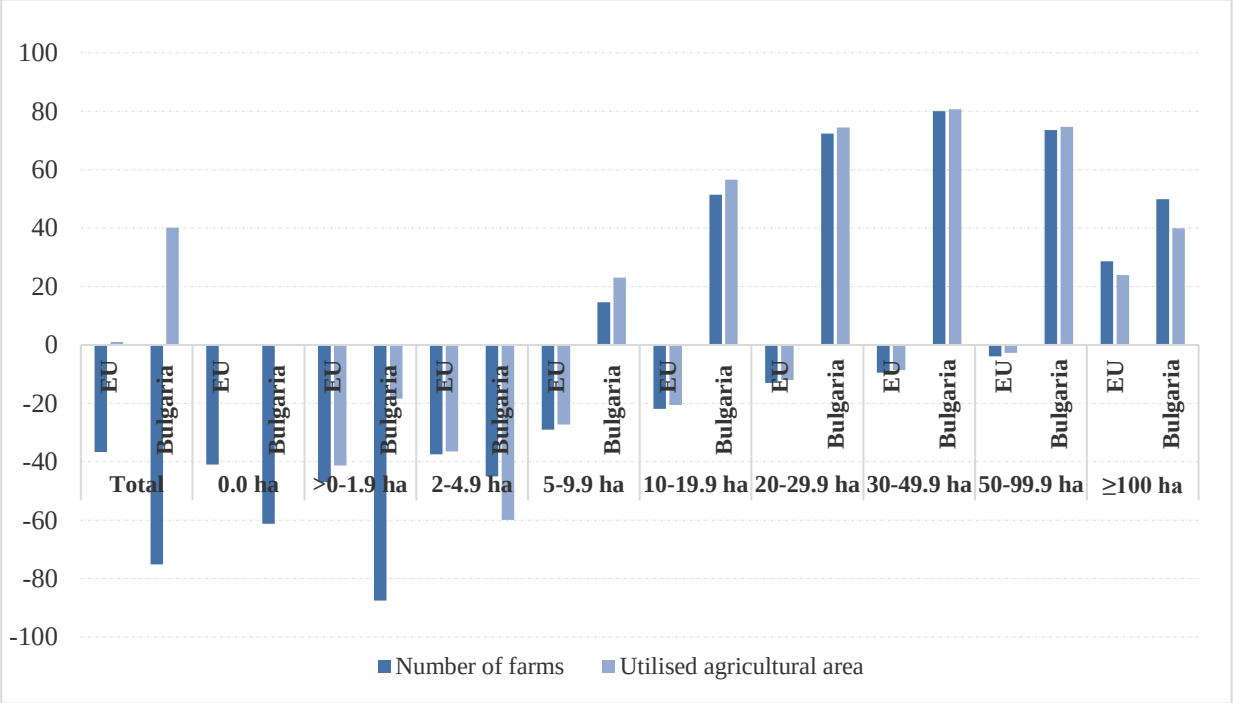


Fig. 1. Number of farms and concentration of UAA by class (2005-2020), %
Source: [14].

In order to observe the trends in farm structure evolution, a base for the survey is the year 2005, before the accession of Bulgaria to the EU.

According to Eurostat FSS data [14], in 2020 around 9 million agricultural holdings are concentrated in the EU. The highest share is in Romania (32%), followed by Poland and Italy with 14% and 12.5%, respectively.

According to Eurostat classification [13] majority of the farms (94.8 %) are considered family farms on which family members provide 50 % or more of the labor force. Bulgaria registers similar results to the observed in the EU-27. Family farms are the most common farm model in all Member States except Estonia and France.

In addition, the small farms remain the main agricultural farm structure. Farms with less than 5 hectares represent 63.7% of all holdings in the EU and 64.5% in Bulgaria. The highest share of small farms is in Malta (96.6%), followed by Romania (90.3%), Cyprus (87.5%) and Greece (74.0 %). Based on the data, it can be concluded that these farms could be an important factor in poverty

reduction and income generation and can address the emerging global challenges with food security and biodiversity.

By contrast, over 7.5 % of the EU's farms are 50 ha or above. In Bulgaria, the share of these holdings is 6.6%, similar to the EU trends. Large farms form the majority of holdings in Luxembourg (53 %) and in France (46%).

Different trends are observed in terms of utilized agricultural area. In the majority of the countries in the EU farms with sizes more than 50 ha accumulate the highest share of UAA. In the Czech Republic and Slovakia these farms concentrate more than 93% of the UAA. On the other hand, in Romania, the farm structure is unbalanced – less than 1 % of all farms are in the 50ha and above cluster. However, they account for around 54% of the UAA. In Bulgaria, the share of these holdings increases by 83%. In addition, the largest holdings by size, above 100ha, represent 75% of the UAA in the country. The observed trends show polarization and disbalances in farm structure in Bulgaria and Romania.

The comparison between Bulgaria and EU-27 shows that the changes in farm structures follow a different development path. The decline in the number of holdings in Bulgaria is 75%. These results indicate a significantly higher reduction than the observed trends in EU-27, which show a decrease of almost 37%. On the other hand, the utilized area in Bulgaria increased by 39%, while in the EU-27, the size of UAA is almost the same for the period under review.

The number of farms in the smallest group (up to 2 ha) decreased by 87%. In addition, the reduction of the UAA concentrated in them is around 18%. In Bulgaria, the results indicate growth in the number and UAA of farms above 10 ha with more than 50%. While in the EU-27, relative share in the total number of the farms and UAA, respectively, decreased by around 21%.

The highest increase in number of holdings in Bulgaria is associated with those between 50 and 99 hectares. Regarding UAA, the most considerable growth is registered in farms between 30 and 50 hectares.

Based on the data it can be concluded that there are positive changes in Bulgarian agricultural structure. The size of the utilized agricultural area is increasing. However, the results indicate some structural imbalances. The accession to the EU and implementation of CAP could not help in resolving some of the issues related to polarization and “land grabbing” in Bulgarian agriculture. The last farm structure survey shows that the challenges associated with overconcentration are not overcome.

Based on the results, it can be summarized that the EU holdings can be divided into three main groups: The first group consists of semi-substance farms for self-sufficiency. In Bulgaria, these holdings play a crucial role in rural areas, especially for low-income families and retired people [1, 2, 19]. The second group are small and medium-sized holdings that are mainly family farms with possibilities to grow and have an important role in sustainable agricultural development. The third group is formed by large businesses and enterprises which accumulated a high share of financial support under Pillar I.

The different farming models among Member-states can also be analyzed by observing the economic size of the holdings.

A comparison between EU Member-states shows their role in standard output (Figure 2). Italy, France, Germany and Spain are the countries that produced the biggest share of standard output. On the other hand, Romania, which is the country with the highest share of holdings (31%), generates less than 4% of the standard output. By contrast, the Netherlands represents less than 1% of farms but concentrates almost 7% of the SO.

Malta and Luxemburg have the lowest share of the standard output. Bulgaria accounts for 1.1% of the agricultural outcome and represents 1.5% of the holdings.

According to Eurostat data, in the EU, the farms with standard output below 2,000 EUR are more than 3 million but account for only 1% of the EU standard output. These holdings can be defined as semi-substance farms. More than 2 million farms are between 2,000-8,000 EUR. In Bulgaria, the share of these holdings is 35%, similar to the EU-27 trends (36.6%). In the country, they concentrate 1.1% of the agricultural output.

The changes in the agricultural structure show a significant decline in the share of these holdings in Bulgaria. For 2010-2020 the farms below 2,000 EUR decreased by 30 percentage points.

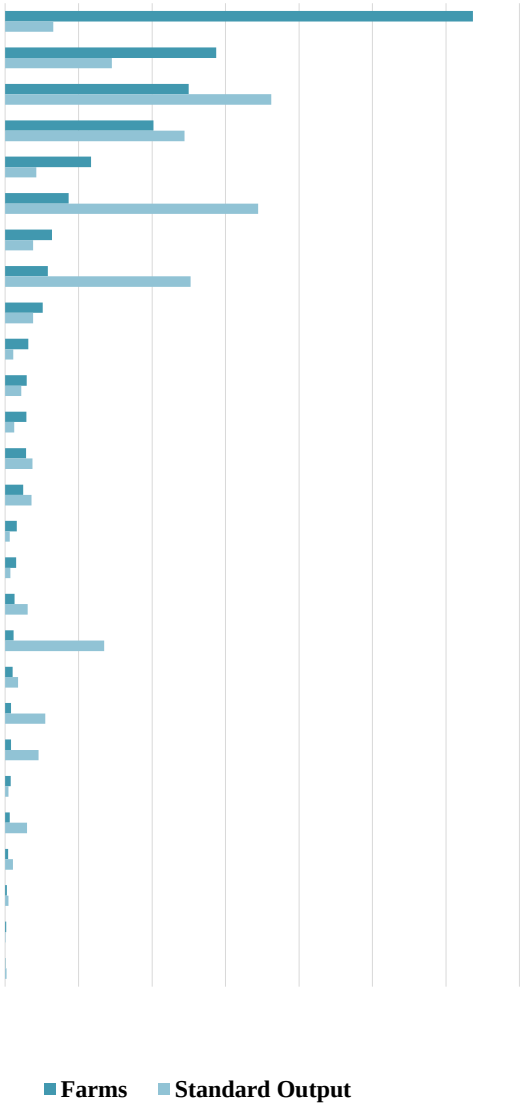


Fig. 2. The share of farms number and standard output, 2020 (%)
Source: [14].

On the other hand, around 3% of the farms in EU-27 generate standard output of more than EUR 250 000. However, it should be noted that these holdings accumulate 57% of the total economic output. In Bulgaria, they form 2.4% of the holdings, accounting for 59% of the agricultural output. The share of these farms increases by 1.4 percentage points in the number of holdings and 17 percentage points in terms of generated output.

Based on the data, it can be concluded that Bulgaria has a dual agricultural structure. Large holdings are growing, while the significance of small farms is declining. Medium-sized farms have a minor role.

On the other hand, small farms play a crucial role in rural areas and help reducing issues such as depopulation and poverty. These trends clearly show that Bulgarian agricultural remains dominated by larger structures.

The CAP was established and designed to "ensure fair income and improve the livelihoods of the rural population" [20]. The CAP reform 2013 set an ambitious goal to resolve issues such as land and financial support concentration, environmental protection and food security [4].

Direct payments are mainly used to support farmers' incomes, which accounted about 70% of the total CAP expenditure [8].

The share of direct payments in farm income varies widely – from around a third, for the lower income classes, to more than half, for the higher income classes [8]. In this way, the income support provided is progressive - farmers with relatively high incomes receive high payments, which contradicts the basic principles of support. [31]. In Bulgaria, the distribution of direct payments is considered as serious issue in terms of land concentration and "land grabbing". Similar results are registered in the surveys of number of authors [26, 27, 30].

The distribution of direct payments in EU-27 and Bulgaria are presented (Table 1) in order to explain the structural changes in Bulgarian agriculture.

The results show a significant difference in direct payments distribution in the years under review, on one hand, and between Bulgaria and EU-27 on the other hand.

In 2010 the share of the farms in the group receiving up to 1,250 EUR is 79%, accumulating only 7% of the support. In EU-27 the share of these holdings in number is lower than in Bulgaria (46%). In 2020 the role of this group declined in Bulgaria, representing 31% of all holdings and concentrating only 1.5% of the financial aid. Although the number of beneficiaries in this group decreased by 15 percentage points for

2020-2021, their role in the received support remains almost the same.

On the other hand, the share of holdings that receive more than 50,000 EUR is increasing in parallel with the concentration of financial support. In Bulgaria, the farms that received more than 100,000 EUR in 2020 accumulated more than 38% of the support compared to 11% in 2010. The share of concentrated financial aid in these holdings in EU- 27 was around 11% for the analyzed years.

The results show that the share of classes between EUR 5,000- EUR 50,000 in the number of beneficiaries and the received financial aid is increasing in Bulgaria and EU-27. However, in Bulgaria, they accumulate support similar to those registered in the above 1,000,000 EUR classes.

Table 1. Distribution of direct payment by classes (%)

| Classes | 2010 | | | | 2021 | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of beneficiaries | | Amount paid to beneficiaries | | Numberof beneficiaries | | Amountpaid to beneficiaries | |
| | Bulgaria | EU-27 | Bulgaria | EU | Bulgaria | EU-27 | Bulgaria | EU |
| Between € 0 and € 500 | 63.06% | 41.43% | 3.95% | 1.90% | 11.16% | 21.21% | 0.25% | 1.05% |
| Between € 500 and € 1,250 | 16.01% | 19.50% | 3.64% | 3.08% | 20.35% | 25.30% | 1.31% | 3.05% |
| Between € 1,250 and € 2,000 | 5.21% | 8.09% | 2.38% | 2.51% | 11.20% | 10.85% | 1.43% | 2.58% |
| Between € 2,000 and € 5,000 | 6.98% | 12.12% | 6.36% | 7.59% | 20.75% | 17.21% | 5.38% | 8.24% |
| Between € 5,000 and € 10,000 | 3.26% | 7.25% | 6.62% | 10.08% | 16.01% | 9.94% | 9.32% | 10.58% |
| Between € 10,000 and € 20,000 | 2.00% | 5.46% | 8.14% | 15.20% | 9.86% | 7.51% | 10.94% | 15.96% |
| Between € 20,000 and € 50,000 | 1.83% | 4.55% | 16.99% | 27.44% | 5.68% | 5.99% | 14.02% | 27.51% |
| Between € 50,000 and € 100,000 | 1.04% | 1.21% | 20.88% | 15.98% | 2.48% | 1.45% | 14.07% | 14.46% |
| Between €100,000 and €150,000 | 0.34% | 0.22% | 11.93% | 5.26% | 1.06% | 0.27% | 10.50% | 4.86% |
| Between €150,000 and €200,000 | 0.15% | 0.08% | 7.45% | 2.56% | 0.58% | 0.10% | 8.08% | 2.61% |
| Between € 200,000 and €250,000 | 0.06% | 0.04% | 4.14% | 1.60% | 0.31% | 0.06% | 5.63% | 1.85% |
| Between € 250,000 and €300,000 | 0.03% | 0.02% | 1.90% | 1.19% | 0.21% | 0.03% | 4.71% | 1.34% |
| Between € 300,000 and€500,000 | 0.03% | 0.03% | 2.47% | 2.38% | 0.25% | 0.05% | 7.43% | 2.70% |
| Over € 500,000 | 0.01% | 0.02% | 3.15% | 3.23% | 0.09% | 0.02% | 6.94% | 3.21% |

Source: Own calculation based on European commission.

Inequality in farm support contradicts the established principles of justice (the principle of the EU Single Market) [28], as some farms are favored over others. Therefore, the financial support is not well-targeted and distributed. Some supported agricultural holdings do not need such considerable support, while others struggle to stay in the farming business. Moreover, such allocation of funds raises land prices and creates barriers for young farmers to enter farming. Small farms are key in maintaining biodiversity using ecological processes and balances [24, 25]. In addition, they are crucial in poverty reduction. The disappearance of small farms could lead to issues with the rural landscape and social exclusion [21].

In addition, it could be noted that in Bulgaria, the share of farmers that receive support is much lower compared to the EU-27 level. According to European Commission data, the share of holdings receiving direct payments in Bulgaria is 29.7% compared to 58% in EU-27 [10]. The results indicate that the country does not benefit enough from the opportunities presented by the CAP.

There is an investment gap between different farms, which hinders modernization, diversification, and implementation of new technologies and affects competitiveness and sustainability in these holdings [1, 32]. These issues affect the ability to fully explore the potential of new value chains, such as clean energy and the emerging bioeconomy.

**Prospects in Bulgarian agricultural structure post 2023**

The transformation in agricultural holding in the EU, particularly in Bulgaria, will be

influenced by the new measures and financial support proposed by CAP after 2023. The 2014-2020 programming period and the reform after 2013 could not address a number of issues. Matthews [18] pointed out that the CAP could not meet the expectation of environmental activists with the results of the greening as a new measure that was directed to green growth. The convergence and better targeting and distribution of financial aid are also major challenges.

The new CAP 2021-2027 proposals are oriented to more ambitious goals [6]. More flexibility and subsidiarity are proposed by the new CAP. The strategic plan models increase the responsibilities of the Member-States. Generation renewal and social challenges are also addressed. Three out of ten CAP objectives are linked to the environment and climate. Local development is also recognized as a priority, with 7.7% of the European agricultural fund for rural development budget [9].

On the other hand, despite these ambitious priorities, the lack of serious changes in the First Pillar raises the question about the impact of these measures on European and especially on Bulgarian agriculture.

## CONCLUSIONS

Based on the analysis, the following conclusions could be drawn:

(1) After the accession to the EU, Bulgarian agricultural structure transformed significantly.

(2) The average size of the holdings, utilized agricultural area and standard output are increasing. There are imbalances in the farm structure. Large holdings are growing, while small farms – disappearing. Medium-sized farms have an insignificant role. Considering the important role of small farm in maintaining biodiversity, the abovementioned trends do not correspond withnew CAP goals.

(3) There is a concern that the lack of serious reforms of direct payments which accumulate the most significant part of the CAP budget could lead to further concentration and polarization of Bulgarian agricultural holdings.

(4) Considering that one of the main goals of the CAP is ensuring fair income for farming families, there is a question whether these financial supports could benefit the profit of larger enterprises instead. In this regard, the CAP post-2023 implementation should be associated with better targeting and reducing support for large structures.

(5) In addition, the links between the Green deal and the CAP could only be achieved if serious changes in direction of direct payments are made.

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# MANAGEMENT OF WINTER CEREAL CROPS FROM SOWING TO FLOWERING – SCIENTIFIC AND ECONOMIC CONSIDERATIONS

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***Abstract***

*Through this paper we aimed to show that, during a vegetative cycle, winter cereal must go through a physiological process of vernalization (low temperatures), which induces and controls flowering and fruiting, also regulating the following development stages. The research objective was to establish the vernalization model on 5 wheat and 2 barley winter varieties, in difficult climatic conditions, generated by water stress, lack of cold periods, but also by some technological aspects. Own research, observations and measurements were carried out in the experimental fields with varieties from south Romania (Modelu - Calarasi county), during the period 2012-2022.It was found that there are significant differences between varieties regarding the parameters required for vernalization, the development of which is genetically coordinated by genes that produce vernalin – the hormone that induces vernalization and which, modified by demethylation, forms gibberellic acid, subsequently participating in the development of the apex, of the spikelets, of the ear, pollinating anthers and soft grains. Uneven seedbed preparation work and sowing depth also create inequalities in water access to seeds, in the achievement of germination and vernalization.*

***Key words*****:** *wheat, barley, vernalization, development stages, yield*

## INTRODUCTION

Winter cereals (wheat, barley, oats) are crops that are sown in one year (autumn, usually in October-November) and harvested in the following year, in June-July.These coordinates are valid for areas with a temperate climate, category in which Romania is also included (Berca et al., 2021) [2].

In areas with small temperature differences between summer and winter and with humidity ensured at the near-optimal level of plant's (crop's) requirements, qualitative transformations in the genetic and hormonal system of the plant are reduced (Ciura& Kruk, 2018; El Sabagh et al., 2022) [4, 5].The need for vernalization is equally low (Pennington and Costa, 2020) [12]. Vernalization is a genetic-physiological process, specific to winter cereals, especially in temperate areas, with lower humidity, through which the plants, after going through a vegetative phase (from sowing to three leaves plants), to initiate the reproductive stage (flowering + fruiting) are forced to go through a cold period in order to receive permission to make flowers and seeds.

Vernalization is a process that occurs with different intensities depending on climatic conditions (Iqbal et al., 2022) [8].Where the average winter temperatures are above 10°C and humidity is ensured, cultivated varieties don't feel the need for an intense vernalization, at the opposite pole are the areas with harsh winters and very low temperatures. According to Fowler (2018) [6], which presents the results of research carried out on very dry soils, there is a correlation between the intensity of vernalization and the resistance of crops to low temperatures over winter.

Our own observations showed that this correlation also exists in the Romanian area, especially in the rustic varieties of cereals.

The same author (Fowler, 2018) [6] claims that in dry areas, the plants that will achieve yields close to their maximum potential are those that enter the winter at least in the three-leaf stage and, most likely, already having tillers. It is obvious that in this phase the wheat is already vernalized.

With lower intensity, vernalization can occur at earlier stages and even at the sprouting stage (Yan et al., 2015) [16]. The yields obtained in this case can be 10-40% lower. It is concluded that for frosty winters it is desirable for vernalization to take place in autumn, and for the reproductive stage to take place in spring. From the specialized literature (Brooking, 1996; Ottman et al., 2013; Streck et al., 2003) [3, 11, 13] the idea emerges that vernalization has significant effects at 2-10°C, with a significant decrease in intensity at temperatures above 11°Cand an obvious loss of its effects above 18°C.

Also, vernalization is genetically coordinated. The main wheat genes that are involved in the physiological process of vernalization are VRN1, VRN2 and, more recently, VRN3 and VRN4 (Hyles et al., 2020; Kiseleva & Salina, 2018; Li et al., 2021; Trevaskis et al., 2007) [7, 9, 10, 15]. According to Trevaskis (2015) [14], all genes concerned with germination-vernalization and flowering initiation are located on the long arm of chromosome 5.

Having all this information regarding the vernalization process, the proposed goal was to find correlations between the achievement of vernalization and the yields obtained in different varieties of cereals, under abiotic stress conditions.

## MATERIALS AND METHODS

The research whose results are presented took place in the south part of Romania (Calarasi county), in harsh climatic conditions, and focused on the behaviour of winter cereals against vernalization and against the frost resistance of the selected varieties.

Observing changes in the vegetative, reproductive, but also productive behaviour of the wheat and barley plants belonging to the different varieties tested, the objectives were proposed and the working method was established.

To begin with, we wondered to what extent the climatic changes, announced as present in the area, influenced the vegetative and reproductive stage of some varieties.

The vegetative period is dominated by two extremely important processes, namely vernalization and frost resistance. Using sigmoidal functions, the quality of vernalization was studied as a function of the temperature factor, and functional corrections have been made when the amount of soil water was well below 50% of the AMI (active moisture interval) and could block vernalization.

Studies and correlations were made between the quality (intensity) of vernalization and the growth, development and productivity of wheat and barley plants.

The research continued by developing methods of growth and development during the breeding and maturity periods. The studies were carried out in the period 2012-2022 (10 agricultural years), in the experimental fields, the research lots and the fields for multiplying varieties belonging to the company Probstdorfer Saatzucht Romania SRL, in the area of Modelu, Calarasi county.

Research was carried out using the survey method in the territory, field photography, plant sampling, measurement of yields components, climate data and soil moisture. Five wheat varieties were analyzed annually, and if one of them was missing, it was replaced by another variety with similar characteristics.

The main varieties selected were Laurenzio, Maurizio, Tamino, Arnold and Monaco, and complementary Balaton, Bitop and Christoph. The two varieties of barley (Finola and Cremona) were included in the study in the last 5 years (2017-2022).

The platform on which the research was carried out is positioned above the Danube valley, on a slightly carbonated soil, with a neutral pH and a humus content of 2.78%. All climate data from the 10 years of research were compared with the multi-year average, whose reference interval is the period 1961-1990. Afterwards, graphs and tables were

used to highlight the differences that appeared and to emphasize possible climate changes.
The calculations concerning the correlations between the days of vernalization and the obtained yields, as well as those between its intensity and the number of spikes/sqm, were statistically processed using the Table Curve 2D program.

## RESULTS AND DISCUSSIONS

Regarding the local climatic conditions, the average sum of precipitation for 30 years (1961-1990, taken as the reference interval) was 473 mm and the average annual temperature was 11.7°C (Figure 1).The distribution of temperatures varied from -1°C in January to 22.7°C in July, i.e. an amplitude of 23.7°C, which indicates typical forest-steppe temperatures. Over this control interval, the monthly variation in precipitation was reduced. Two not common situations were encountered, namely:
(i)the average for the first 4 months and the last 4 months of the interval, so in 8 of the 12 months of the year, the precipitations were uniform, positioned between 40-45 mm;
(ii)during the experimental period (2012-2021 for climatic conditions), the average monthly amount of precipitation was 584.1 mm, i.e. 115 mm more than the 30-year average, placing the region in a forest transition zone.
The variation of the monthly average of temperatures was, in amplitude, greater than in the multiannual control average.
From this point of view, the difference is not great.
Very large is the monthly variation of precipitation each year. During the 10-year period (2012-2021) there were months, for example in the 2016-2017 agricultural year, where no mm of precipitation fell (December 2016 and January 2017) and numerous months in different years where less than 10 mm were registered.
Every year there were 2-4 months in this situation. Autumn and spring droughts were frequent and contributed to the significant reduction of both the induction of the vernalization process and the harvests obtained.

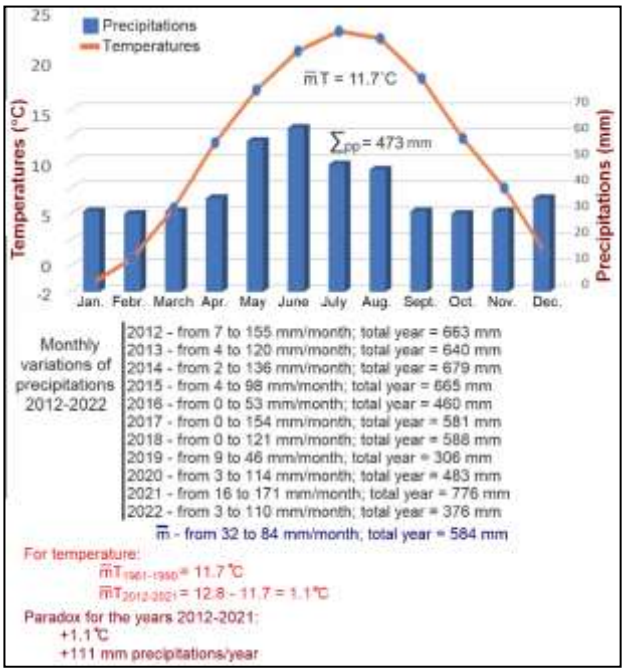

Fig. 1. The evolution of average monthly and annual temperatures and precipitation, for the period 1961-1990, completed with the interval 2012-2021
Source: Own processing after public and personal data.

Based on all these data, the paradox was reached according to which:
(a)the average annual temperature in the period 2012-2021 is 1.1°C higher than the multi-annual reference average;
(b)average annual precipitation is 111 mm higher than the control average.
If we accept the idea that there have been climate changes that have increased temperatures by 1.1°C in 10 years, i.e. 0.11°C/year, then the 111 mm/year increase in precipitation is no longer justified by climate change.
Given that December was rainy in 30% of cases, with precipitation over 100 mm, it is difficult to explain the continuous decrease of the soil water reserve, which in the years 2016-2021 influenced the quality of vernalization. At the same time, the temperatures over the winter were high enough to not be able to test the frost resistance of the studied wheat and barley varieties.
Table 1 lists the 10-year average temperatures of the four months (November-February) that could have contributed to the induction of vernalization ($0 \rightarrow 10$°C).

Table 1. Average temperatures and precipitation in the months of vernalization and frost, 2012-2021

| Crt. | Month | Average T (°C) | Average P (mm) |
|---|---|---|---|
| 1. | **Nov.** | 7.67 | 54.9 |
| 2. | **Dec.** | 2.53 | 54.9 |
| 3. | **Jan.** | 0.11 | 43.8 |
| 4. | **Febr.** | 2.62 | 31.8 |

Source: Own determination.

It is found that the temperature factor was in optimal parameters, so from a biological point of view the vernalization process was possible. Water, which is the second absolutely necessary factor for vernalization, comes mostly from precipitation, and when the conditions are right, from vapor condensation on plants and in the topsoil. Crop vernalization models are very numerous, depending on the diversity of climatic conditions, but also on the studied varieties.

Among the many possibilities of grain vernalization, our own studies and calculations led to the detection of three models that were the most common in the research and observations from Modelu (Călăraşi county), as shown in Figure 2.

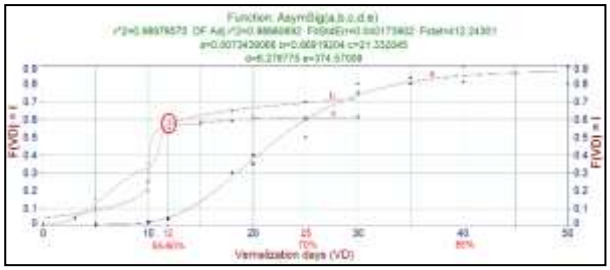

Fig. 2. Vernalization intensity – average for wheat and barley varieties, under different conditions offered by the autumn months from 2012-2022
Source: Own determination.

Model 1 – the years 2012, 2013, 2015, 2021 and 2022 had, in the autumn period (the months of November and December), enough water to ensure a humidity suitable for the demands of vernalization, and the temperatures were also optimal. Vernalization had a slow evolution, in the form of a wide sigmoid (curve "a" in Figure 2). At 25 days the process reached 60% of the intensity, at 30 days it had reached 72%, and around 40 days it ended, with a yield of about 85%. In all these years, the average production of the varieties was between 5,000-6,500 kg/ha, depending on the evolution of the vegetation factors from spring until the formation of the ear.

Model 2 – the years 2014, 2016, 2017 and 2018 had temperatures favorable to vernalization as early as autumn, and consistent rain fell in November (58 mm in 2014, 74 mm in 2016, 154 mm in 2017 and 64 mm in 2018).Under these conditions, vernalization took place more quickly. After 12 days from emergence, the rapid vernalization phase (3 leaves) was reached, and the process reached 55-60%(curve "b" in Figure 2). The maximum was achieved at 25 days, reaching approximately 70%.

Model 3 – was also the shortest and occurred at the end of winter 2020, after a severe fall and winter drought. Rains in December 2020 (114 mm) allowed the plants to germinate, thanks to positive temperatures in January and February (2 and 6°C respectively). Vernalization took place in a few days, after 12 days from sunrise it had achieved 55% of its activity, and after 18 days it reached 60% (curve "c" in Figure 2). More couldn't be achieved, also correlated with the drought that followed in spring and early summer. Vernalization couldn't achieve its goal of initiating flowering and driving the crop toward reproduction and production. Yields were close to zero, with one exception – the Bitop variety, which obtained 3,165 kg/ha. It is quite possible that this cultivar may have vernalized better and/or had greater drought tolerance.

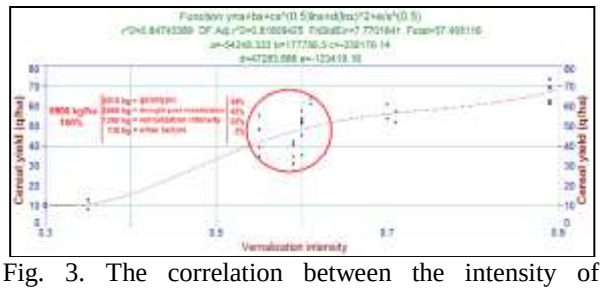

Fig. 3. The correlation between the intensity of vernalization and the obtained yields in wheat and barley (10-year average)
Source: Own determination.

Starting from the three models, the question arises whether the intensity, the volume of the vernalization process is correlated with the production. Taking into account the large time

gap between vernalization and maturity and the large number of intervening factors, whether natural or anthropogenic, this correlation shouldn't exist. The continuity of some negative or positive factors, both for vernalization and for yields, make this correlation possible, at least in the studied varieties (Figure 3).

The correlation ratio of the function is $r^2$ = 0.847, and the function is logarithmic, slightly asymmetric. The difference in yields between the years with the least vernalization and those with the best vernalization was, on average, 5,900 kg/ha. Although, statistically, this difference is very significant, we cannot attribute it entirely to vernalization. From the moment of vernalization to maturity, a minimum of 150 days passed, during which the biotic and abiotic factors were extremely variable.

The calculation of the influence of the factors was carried out, according to the methodology proposed by Berca and Draghici (1972) [1]. It turned out that vernalization could have an influence of 22% (±5%).The main factors that created variations in the statistical system studied were genotype, with 34%, and post-vernalization drought (42%).

Among the selected varieties, the biggest variation for the three studied factors is the Maurizio variety, which in good vegetation conditions produced 6,111 kg/ha (year 2021), and against the background of weak vernalization and droughts in the spring, it had a yield of only 930 kg/ha (year 2020).The Bitop and Laurenzio varieties had a better production stability, with smaller variations generated by the studied factors.

It should be emphasized that when the vernalization of the field is below 50%, followed by severe droughts in winter-spring, as happened in the agricultural year 2019-2020, the grain production cannot exceed 3,000 kg/ha. Figure 4 shows the correlation between the intensity of vernalization and the density of the crop, i.e. ears/sqm. Based on the information collected from the field, it appeared that vernalization leads to the initiation of flowering, and it was evident that at higher indices of vernalization, we have more ears, which can lead to a higher yield.

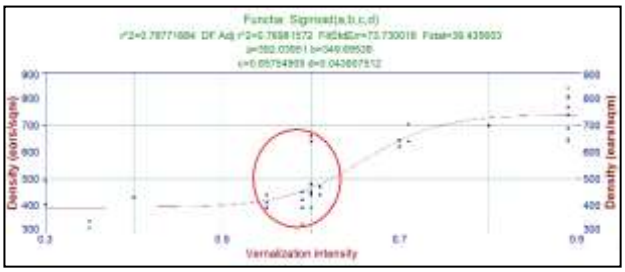


Fig. 4. The correlation between the intensity of vernalization and the density of ears/sqm
Source: Own determination.

At a vernalization below 50% there are problems with full initiation of flowering. If vernalization is sufficient, 70-90%, complete reproductive organs are formed, but a significant number of flowers disappear if the months of February-April are very dry. Sometimes numerous ears may form, but they will not always be full of grain. Also, the brothers dry up or end up forming small ears, insignificant for the productivity of the plants and of the crop, as a whole.

## CONCLUSIONS

Autumn wheat and barley varieties cultivated in the arid area of the Romanian Plain, in order to produce flowers and fruits, the main elements of production, are obliged to go through the physiological phase of vernalization.

Vernalization can be done in early winter, after the cereal seedlings have reached the three-leaf stage. The process takes place rapidly at temperatures of 0 → 10°C, more slowly at temperatures of -5 → 0°C and +10 → +15°C, and outside these ranges it doesn't take place at all. The studies carried out in a period of 10 agricultural years (2012-2022) showed the existence of three vernalization models, which were differentiated according to the water and air regime of the soil (maximum at 75% AMI and 0-10°C).

Vernalization took place between November and February, being able to intervene at any time when the requirements for temperature and humidity were met.

In conclusion, the vernalization period was different, depending on the climatic and agrotechnical conditions. Monitoring the

vernalization process in the field will need to be part of cereal crop management.

The uniformity and intensity of the process are significantly influenced by the quality of the germination bed, the uniformity of the land during sowing, the conservation of moisture and the quality of the seeds. The seeds of the barley cultivars germinated faster and had a shorter vernalization period. The correct management of vernalization, under the given conditions, can lead to the reduction of the duration of the vernalization phase, to the uniform induction of flowering, to obtaining more uniform and higher yields and to a profitability of about 5-15% higher.

The processes of vernalization, resistance to frost and induction of flowering are genetically coordinated by the VRN gene complex, which throughout the vegetation periods induced the specific phytohormones, which through particular genetic processes (activation, inhibition, disappearance) allowed the unfolding physiological mechanisms during the entire period of vegetation and crop reproduction. These mechanisms were disturbed during periods of prolonged droughts, which led to the decrease of growth and production indices and to the reduction of yield and its quality, as happened in the year 2020, in particular.

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# OSMOSIS BETWEEN HUMAN CAPITAL AND DEVELOPMENT AND ITS IMPACT ON THE 21$^{st}$CENTURY ECONOMY- A REVIEW

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***Abstract***

*In the knowledge-based economy of the 21$^{st}$century, educated human resources are seen as a capital asset invested in the entity, and human capital theory seeks to explain, from an economic perspective, the phenomena arising from this process. The development of education and scientific spheres requires huge long-term investments, which must be analyzed from a social approach. Neither evaluation experience nor the methods applied provide a clear-cut solution, so evaluating an investment in human capital is a complex problem from both a practical and a scientific point of view. This research started from the hypothesis that investing in human capital will provide competitive advantage and sustainability in the complex world of the economic environment, reviewing the theory and evidence on the economics of human capital. Triangulation was chosen as a research method being considered the most adequate for the expected results and additionally because it allows to identify the most relevant aspects of this field that endorsed the proposed hypothesis. The main conclusion and results are that the emphasis has been placed on human capital just at the personal level, rather than at the level of unity and organization. Furthermore, research into the channels that have a causal effect on development has revealed that education is considered an instrument of developing human capital that promotes direct economic growth. Data analysis demonstrates that the theory of human capital is a convincing explanation for economic growth. In addition, the findings of the research have shown that the debate over equality vs. efficiency in economic development is centred on the human capital dimension.*

***Key words*****:** *knowledge-based economy, human resources, economic development*

## INTRODUCTION

Human capital theory was implemented in pre-modern eras after its development and application to modern economies. A key criticism of the human capital theory at first, which the author herself disagree with, was that it was inapplicable to the Industrial Revolution because there was no obvious correlation between economic expansion and literacy throughout early modern Europe (Allen, 2003) [2]. By utilizing different metrics of human capital and taking a closer look at various periods of economic history, research conducted over the past ten years has challenged this assertion. A number of economists find that formal education played a significant role in the Industrial Revolution using panel data on regional enrollment rates from 1816 to 1882, with relatively high pre-industrial levels of education accelerating the adoption of technology (Becker, 2009) [6]. The paradox that human capital is a powerful predictor of economic success today but not, it seems, during the Industrial Revolution is also addressed by Squicciarini and Voigtlander (2014) [19]. A lack of focus on the top of the skills distribution, the entrepreneurs and engineers that propelled early modern nations from stagnation to growth, is said to be the reason why prior research failed to uncover the impact of labor force skills on economic growth. They conclude that the existence of knowledge elites predicts regional economic growth after 1750 with great clarity using data from France. This illustrates one of the drawbacks of using population averages to measure education (even when considering abilities rather than years of schooling)—they don't take the distribution of education into account. At earlier periods of economic history, the relationship between education and economic expansion has been shown. According to economists who have studied the history of the Roman Empire, the empire's economic expansion was the result of

investments in human capital, which were higher than they had ever been in Europe before 1500. The educated workforce of Japan contributed to the country's quick and widespread embrace of Western technology, and we shouldn't overlook the role that human capital played in the economic development of the Jews. Meanwhile, rising literacy rates in the late 19th century contributed to Protestant economic prosperity. The contribution of education to rising labor productivity and labor participation throughout American history is also worth mentioning. Lastly, we recall the relevance of large-scale human capital accumulation in fuelling the economic miracles in East Asia during the 1960s and 1990s.

The economics of human capital is reviewed in this study, with a particular emphasis on the educational component of human capital and how it affects economic growth in emerging nations. The emphasis is on economic growth, or the change in gross domestic product, while acknowledging that human capital accumulation affects a number of other factors, including social development and health.

## MATERIALS AND METHODS

This study begins by reviewing the idea of human capital and then labor market research on its relationship with individual income before turning to its impact on aggregate income, tracing the development of economic theory on this topic from its inception to its inclusion in macroeconomic growth models. As a result of recent developments in the evaluation of human capital, it was also taken into consideration how the estimation of the effect of education on development has evolved.

It is not merely an intellectual exercise to comprehend the subtleties of the function of human capital in development. Proof of it can influence public policy and encourage it, ensuring that limited resources are invested effectively in human productive capacity to speed up economic growth and reduce poverty. In addition to summarizing research on how human capital affects economic growth through labor productivity, it was also drawn attention to new data that shows how crucial it is to invest in people in order to advance equity and environmental sustainability, both of which are essential for sustaining economic growth in the twenty-first century. In order to achieve these objectives, it was approached a mixed research methodology, namely triangulation whereby there were overlaid data from three categories of resources: literature, documents, and data provided by globally recognized research tools. Using this method, the degree of convergence of the data obtained was an indicator of the validity of the results.

## RESULTS AND DISCUSSIONS

### Human capital and the labour market

Although the importance of education in the economy had been acknowledged for millennia, human capital did not start to take center stage in economic modeling until the 1960s, in part due to measurement issues. Explaining salary disparities in industrialized economies was among the initial uses of human capital in economics. Jacob Mincer recommended using the number of years spent in school as an indicator of human capital, contending that the primary goal of education is to prepare students for the workforce. He developed the following human capital earnings function on the basis of this concept (Mincer, 1974) [13]:

$$\ln y = \ln y_0 + rS + \beta_1 X + \beta_2 X^2 \qquad (1)$$

where:

y is a person's earnings on the job, S is the number of years the person spent in school, X is the number of years the person has worked in the field, and y0 is the expected minimum wage for a worker with no training or experience. The average returns to education and job experience, which the earnings function is intended to quantify, are represented by the variables r and β1, respectively. This kind of equation has been defined in a variety of ways, along with the inclusion of various factors like race and gender, and it serves as the foundation for a

substantial body of work that examines the relationship between education and income. Empirical studies of human capital will increasingly depend on educational attainment as measured by years of schooling (for microstudies) and average years of schooling in the next decades (for macro studies).

The Mincerian technique has been applied to a number of labor markets, as reviewed by Greek economists Psacharopoulos and Dimitrios Patrinos [16]. According to their data, every extra year of education results in a 10% increase in earnings near the middle of the distribution (r = 0.1). Yet, the marginal return to a year of education varies significantly over time, by geography, and by education level and demographic group. They discover that women's education has an added benefit (9.8% for a year of female education versus 8.7% for male education). The labour market data for working men from the 1960s to the 1990s suggests that in developing countries, primary education provided the highest returns, with the marginal benefit of education declining with years of schooling. They also demonstrate that the returns to education are higher in low-income areas (Patrinos, 2011) [14].

Although the Mincer studies provide empirical proof that education accounts for a large portion of the variation in individual incomes in emerging nations, they have a number of drawbacks. The strategy does not account for the benefits of education in the informal sector because it only permits the analysis of formal jobs with wage data (typically for men). However there is growing proof that education boosts both the informal economy's output and job prospects in the expanding digital economy. Additionally, there is a body of research (Huffman, 2001) [11] demonstrating that education increases agricultural output, particularly in settings where farmers have access to low-cost agricultural technologies as a result of their education.

The Mincerian approach has also been criticized for failing to adequately account for the complexities of contemporary labor markets. The benefit of education in enhancing a worker's job security is not adequately captured by the Mincerian approach, which is particularly important in post-crisis economies with high unemployment rates. Also, it is unclear if the best way to gauge a person's human capital is by counting the number of years they spent in school (which ignores the quality of education). Microeconomic data that measure levels of abilities acquired via education (an output of education) rather than years spent in school are receiving more and more attention (an input to education).

**Econometric quantification of human capital**

The dilemma of endogeneity stands in the way of accurately evaluating how human capital build up affects development. The notion that education spurs growth or, more accurately, the fact that governments engage in education only after they have established the financial resources to do so is reflected in the positive correlation between education and development indicators. Richard Ainley Easterlin uses historical data from 25 sizable countries to show a connection between primary school enrollment and economic growth. He points out that in industrialized countries, the spread of public education came before economic take-off, and that in many countries, high economic growth was not followed by a sharp increase in primary school enrollment (Easterlin, 1981) [8].

Economists have just recently been able to formally address this sequencing issue. Improvements in developing country data, combined with advancements in econometric methodology (panel methods, instrumental variables), have made it possible to incorporate human capital in economic modeling in ways that were not previously possible and have strengthened the case for the link between human capital and development (Prelipcean and Ungureanu, 2023) [15]. In a recent example, R. Barro and J. Lee use the 10-year difference in parental education as an instrumental variable for current educational attainment to adjust for the simultaneity of education and development. They estimate a macroeconomic return of 5-12% for one additional year of average schooling (Barro, 2013) [5].

Once more, they use a recently created panel dataset on educational attainment and regional economic growth to apply a Lucas model of human capital externalities. They draw the conclusion that, as a regional extension of the national-level research conducted in the 1990s and 2000s, human capital has a substantial explanatory capacity for regional variance in income.

The second modeling issue is related to measuring human capital. Rates of schooling and years of schooling, the two most common indicators of human capital, are more likely to be inputs into the creation of human capital than outcomes of an individual's education. Additionally, the model implicitly assumes that the value of a school year in the United States and the Republic of the Democratic Republic of the Congo is the same in an effort to establish a relationship between human capital and economic growth based on data regarding school years from more than one country. Also, the concept compares a primary school year to a year in a doctoral program (Aghion, et al., 2009) [1].

The tremendous expansion of education in emerging nations and the increase in average school life have not led to widespread economic growth. The adjusted net primary enrolment ratio in developing nations climbed from 80% in 1990 to 90% in 2011. Throughout the previous 20 years, net enrolment ratios have dramatically increased. The amount of money spent on education domestically and by donors has also greatly increased, indicating a rising understanding of the value of a foundational education for growth.

E. Hanushek and E. Wössmann, two economists, conclude that if performance indicators are incorporated into the model, the level of performance as assessed by years of education statistically becomes negligible in explaining country disparities in per capita income. This suggests that education only influences economic growth inasmuch as education results in the acquisition of skills, and that the development of cognitive skills rather than the amount of time spent in school affects income and economic growth (Hanushek, 2007) [9]. Additionally, there is some evidence that certain materials have a more significant effect on growth than others. In fact, these measurement problems can help to explain a lot of the data that refutes the human capital theory. For instance, the decline in educational standards at the end of the Soviet era can be used to explain the apparent paradox of a substantial stock of human capital (measured by years of schooling) and the economic collapse of the Soviet Union (Didenko, et al., 2013) [7].

Higher education has seen some adoption of the signaling hypothesis; for instance, according to economist C. Holmes, the expansion of higher education has no statistically meaningful relationship to economic growth (Holmes, 2013) [10]. Yet, this outcome is dependent on the human capital proxy used. Both the number of researchers employed and technical skills at the completion of compulsory school are significant determinants of economic growth, and both are correlated with higher education quality. The association between education and development is strong if human capital is correctly quantified to include variances in the abilities transmitted through school. If non-formal education, lifelong learning, and vocational training can be taken into account thanks to improvements in measurement and data gathering, this relationship is likely to become even more obvious.

**Human capital and the quality of economic growth**

The focus of discussions thus far has been on the effects of higher labor productivity and economic development, as measured by per capita GDP growth rates. However, there are also ways that human capital might boost economic growth, especially in light of current global trends like equity and resilience. The interaction between equity and education constitutes the initial channel. Both developing and industrialized nations have seen an increase in income disparity in recent decades. Faster and more durable growth are closely correlated with lower net inequality. Income inequality is mostly a result of educational inequality. According to a study on Brazil, education inequality accounts for 29% of the country's excessive income

inequality (which is higher than average globally compared to the United States), skill premia account for 32% (the wage gap by skill level in Brazil is 50% higher than in the United States), and public transfers account for 39%. (e.g. urban subsidies, retirement pensions). The majority of the income inequality in Brazil is caused by education since skill premiums are somewhat impacted by education distribution (education affects the relative supply of skills). Human capital also contributes to economic growth through its effect on equity to the extent that equity promotes economic growth. There is also some evidence to support the theory that economic disparity contributes to the recurrent economic crises that have wreaked havoc on the global economy for centuries (Atkinson, 2011) [3].

A secondary channel via which education enhances the quality of economic progress is the growing threat posed by climate change. According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2013), a 2°C increase in the global average temperature will result in economic losses of about 1% of yearly GDP and more violent heatwaves and droughts that will cause food and water shortages. Developing nations with high levels of female education do better in the face of natural disasters, preventing economic progress from being offset by climate change, by regulating incomes and weather patterns.

According to some economists, a strong and equitable stock of human capital is necessary not only for the quantity of growth but also for its quality in order to ensure that high growth rates in developing countries are sustainable and long-lasting. This is supported by recent studies on equity and disaster resilience (Thomas, et al., 2000) [20].

Exogenous growth models, which specify per capita income as a function of physical capital, the size of the labor force, assumed (exogenous) rates of technological progress, saving, population growth, and residual total factor productivity, were used by economist Robert Solow to investigate differences in the economic output of different countries in the 1950s (which increases the productivity of capital and labour). Hence, all components of economic output are observable (physical capital and labour) (Balan, 2021) [4]. By regressing the logarithm of per capita income on the logarithms of saving rate, depreciation rate, technical growth rate, and population growth rate, the basic exogenous growth model is applied to the data. The fundamental exogenous growth model has positive aspects, but empirical studies reveal that it is ultimately irreconcilable with reality. According to a standard Solow Swan regression, the residual accounts for the remaining half of the variation in per capita income (total factor productivity). The predicted sizes of the effects of saving and labor force expansion are excessive, nevertheless. For instance, the wealth disparity between the US and India could only be explained by implausibly vast variations in the stock of physical capital. The capital-to-income ratio has a default value of 0.6 according to the baseline specification, although in reality, the overall capital-to-income ratio is closer to 0.3:

$$Y(t) = K(t)^{a} (A(t) L(t))^{1-\alpha} \qquad (2)$$

where:

Y(t) is production for time period t, K(t) is the stock of physical capital at time t, L(t) is the size of the labor force at time t, A(t) is a residual, catch-all variable, and is the elasticity of output with regard to physical capital. Exogenous growth rates g and n are used to measure the growth of A and L over time, while a fixed percentage of production, s, is saved and put into physical capital each period. These flaws show that the basic Solow-Swan model omits essential variables that influence economic growth. Given the compelling evidence that education plays a key role in determining income at the individual level, it follows that human capital plays a significant role in determining the income and growth of nations. As a result, it should be taken into account when performing Solow-Swan growth accounting exercises. Mankiw, Romer, and Weil (1992) [12], who added human capital to the Solow-Swan exogenous growth model, empirically

evaluated this hypothesis. They used cross-country regressions that included human capital as a component of production along with labor and physical capital to examine the association between investments in human capital and economic progress. The proportion of young people (12–17 years old) enrolled in secondary schools in a country, multiplied by the percentage of the working-age population that is of secondary school age, serves as an approximation of the pace of human capital accumulation in their expanded model (15-19 years old). For non-oil economies, they discovered that a 1% rise in their substitution measure raises GDP per person of working age by 0.66%. This effect is statistically quite significant:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} (A(t) L(t))^{1-\alpha-\beta} \quad (3)$$

where:
Y(t) is output for time period t, K(t) is the stock of physical capital at time t, L(t) is the size of labor force at time t, H(t) is the stock of human capital at time t, A(t) is a residual, catch-all variable, and is the elasticity of output with respect to physical capital and β is the elasticity of output with respect to human capital.
The shortcomings of the original Solow-Swan model are resolved by human capital accounting. Eighty percent of the variation in per capita income among countries is explained by the augmented model. In the expanded model, the suggested alpha coefficient is reduced to a more logical 0.33. When the elasticity of production with regard to saving rises from 0.5 in the initial version to 1, the income disparity between wealthy and poor countries can no longer be explained by implausible variations in physical capital inventories.
Many studies have examined the link between macroeconomic development and human capital using different human capital proxies. Greek economists G. Psacharopoulos and A. Arriagada [16] proposed average years of schooling as a proxy for human capital in the paper "The Educational Composition of the Labor Force: An International Comparison," and they created a dataset of average years of schooling for the working age population in 146 countries since 1950. (Psacharopoulos, 1986) [16]. This dataset has emerged as the most important human capital proxy for calculating global growth.
The returns to human capital that are calculated in macroeconomic research are typically two to three times larger than those that are estimated in microeconomic studies (Ungureanu, 2020) [21]. Education externalities can be used to explain some of the variances in micro and macro estimates of returns to human capital. Just the benefit to the student who is receiving the education is included in wage-based return estimations. But, the economic advantages of education go beyond the person. Knowledge is a shared good, free from competition and exclusion. Robert Emerson Lucas Jr. incorporated externalities into his endogenous growth model to account for this and ensure that each individual is more productive when surrounded by highly trained individuals (Lucas, 1988) [17].
Evidence suggests that the impact of education varies depending on education level, demographic group, and early stage of development at the micro level. Although there is no discernible connection between primary education and economic growth, the vast sample size may obscure country-specific idiosyncrasies. For instance, a case study of India utilizing data from 1966 to 1996 revealed that primary education's strong benefits have a greater impact on economic growth than those from higher levels of education (Self, 2004) [18].
Basic education is essential for catching up (providing workers with the skills to apply technologies at the global frontier), while higher education is necessary for advanced economies to grow. This is because the relationship between educational attainment at various levels and economic growth depends on a country's level of development (giving workers the skills to innovate and push the global technological frontier further). These cross-country regression analyses could have an issue due to the human capital measurements they employ. This restricts the model's application to emerging nations since

it ignores differences in primary school enrollment among them. Enrollment and years of education are often poor indicators of human capital. The quality of education is not taken into account, and they only record the inputs rather than the results of an educational system. In fact, the outcomes of economic growth models are sensitive to the choice of human capital measure, so the ability to precisely measure human capital is necessary for the valid empirical support of the human capital theory.

## CONCLUSIONS

A variety of freedoms, such as political rights and choices, freedom from compulsion, and freedom from income poverty, are gradually activated as part of development. People can obtain the skills they need to practice various freedoms and access essential human rights through education. Hence, development has education as both a means and an end. The argument between justice and efficiency in economic development is mostly driven by the question of human capital. There is no such trade-off, according to mounting data reviewed in this study, and equity and growth are development objectives that can be pursued concurrently. Investing in education, particularly basic education in developing economies, becomes a clear priority as a result. Both emerging and developed economies extensively subsidize education, and there is compelling evidence that investing in human capital pays off for both the public and the private sector. However, there are non-market components of well-being that are influenced by the accumulation of human capital, such health and civic involvement, which are ignored in GDP per capita growth even though they can influence economic growth.

It has been extremely challenging to thoroughly analyze the subject of human capital in the current study, despite the concept's high level of attention among academics. Furthermore, research on human capital has advanced through time and is now occasionally seen as a subset of research on intellectual capital.

It is considered that it is vital to extend the concept in larger aspects based on my study of human capital efforts. Human capital has been emphasized only at the person level rather than at the unit and organizational levels, where it can work at a wider level, which has led to the word being advocated as a justification for advancing the subject of human resource development. Examining the evidence on the channels that have a causal effect on development, education is viewed as a means of developing human capital that directly promotes economic growth. The analysis of the available data demonstrates that the human capital theory is a convincing explanation for economic growth. According to this theory, investments in human productive capacity result in a more mobile, adaptable, autonomous, and creative workforce that is able to learn new tasks and apply technologies and equipment to boost production.

But, this is not supposed to be the sole explanation. The spatial perspective on development places a strong emphasis on the value of ecology, climate, and the surrounding environment for human health. According to the institutional view of development, a crucial element in economic growth is how society is organized and the productive incentives it provides to people and businesses. The human capital theory holds that by making economic transactions easier, trust and social cohesion promote economic growth. These opinions should be viewed as a supplement to the human capital theory because they are not mutually exclusive. Although the development of human capital is a necessary component for social advancement, impoverished nations' recent economic performance has proven that it is insufficient for economic success. It must be accompanied with welcoming institutions and regulations that enable people to use their education to pursue economic opportunities. The findings of this research help us to understand that the equality vs efficiency debate in economic development is centered on the size of human capital. There is no such trade-off, and equity and growth are development objectives that may be pursued

concurrently, according to mounting evidence. Investing in education, particularly basic education in developing economies, becomes a clear priority as a result. Both emerging and developed economies extensively subsidize education, and there is compelling evidence that investing in human capital pays off for both the public and the private sector. However, there are non-market components of well-being that are influenced by the accumulation of human capital, such health and civic involvement, which are ignored in GDP per capita growth even though they can influence economic growth.

The future research on human capital needs to be examined further. Human resource development experts could look closely at the connections between human capital and other factors, such as how it might improve the development of human resources in specific industries and how it might be essential to fostering employee engagement.

At the same time, a future research will be extended on the EU rural development programs for the industrialization of the rural ecosystem, alternative paradigms in the rural development process, smart rural development in the context of public-private partnerships, and the level of rural development in Romania. Although these directions are currently speculative and may be examined from other angles depending on the development and findings of the research, applicable and impartial conclusions for this area of study would be useful.

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# QUALITY FOOD PRODUCTS REGIONAL POLICY. CASE OF AGROTRANSILVANIA CLUSTER, ROMANIA

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***Abstract***

*Particularly traditional foodstuffs could be exploited for branding and marketing and are essential for authenticating a national or ethnic culture. It has been referred to as `culinary nationalism` or `gastro-nationalism` when nations assert ownership of particular foods and give them institutionalized protection. The European Union (EU) has developed quality schemes as legal mechanisms for controlling ownership and control over certain food products in the context of the globalized food market. The purpose of this qualitative case study is to identify the specific certification schemes to integrate Romanian traditional agri-food products with focus on the study case of AgroTransilvania Cluster, where under the umbrella of the Cluster were created 4 voluntary certification schemes. To measure the impacts of these voluntary certification schemes had to be into consideration the position of the state institutions, the interpretation of traditional products by different national actors, and producers' intentions. Certification schemes and Food security works hand in hand which bring us to the conclusion that certificate products are more reliable to human consumption and friendly with the environment than the conventional ones.*

***Key words*****:** *traditional products, voluntary certification, national regulations, cultural heritage*

## INTRODUCTION

Consumers are adopting more mindful eating habits in favour of sustainable, certified, and high-quality foods, according to recent medical research on the connection between dietary intake and clinical diseases which leads to a growing consumer concern about their health (Brons & Oosterveer, 2017; Smith-Spangler, 2012; Bublitz, 2013) [4, 27, 5]. Among the afore mentioned products, consumer preference is developing for organic items as well as regional and local foods. As for the former, the European Union has created a number of trademarks that are utilized as tools for food regulation. Their primary duty is to safeguard, educate, and support consumers' food decisions (Dias & Mendes, 2018) [11]. Food labelling, agriculture, and the food industry are all interconnected ideas. The balance between them is influenced by corporate and regulatory policies at the national and international levels as well as pedoclimatic variables and the state of agricultural technology development (Glogovetan, 2022; Vilke, 2021) [16, 32]. In numerous countries, consumer preferences for nutritious, beneficial, and/or organic foods are on the rise, which is driving interest in traditional and ethnic foods that are produced locally. A "traditional" product is what? These foods can be defined simply as those that are typically cultivated or raised organically and consumed while still in that form or after only minimal preparation (drying, cooking, and natural fermentation). Food consumed and cooked by a group of people who have a similar religion, language, culture, or ancestry is referred to as "ethnic" food. Naturally, a lot of ethnic cuisine is created using traditional cuisine, and vice versa (Prakash, 2016) [23]. The shift to a "smart" food system, or more specifically the "farm to fork strategy," that began soon before the new decade is defined by the following: food is more effective, healthier, and environmentally friendly because it comes from "intelligent" farming methods

rather than traditional ones (Bu, 2019) [6]. In order to reduce food waste, EU agricultural policies are based on practical steps to develop the entire food value chain, from production and distribution to consumption (Sikora, 2021) [26]. Therefore, because they are created from raw materials developed in accordance with production methods and techniques in a precisely defined geographical area, agri-food items that have received quality system certification are regarded as perfect meals. The products in question are distinguished by unique, natural production characteristics, customs, and/or historical procedures that have developed over time and are irreplaceable (De Canio, 2021) [9].

The European Union offers a legal framework to protect typical foods, so it should come as no surprise that at the same time it supports their regional differentiation. Geographical areas are significant and contribute value in markets where food safety, quality, and reliability are increasingly in demand (Luceri, 2016) [18]. The authenticity of logos and label information become crucial when communicating the presence of desired qualities for consumers. Different quality seals come in various forms. Specific quality marks guarantee quality, safety, product origin, environmentally friendly production, etc. in contrast to generic quality marks, which represent all of a product's quality attributes. In addition to international labels, every nation has a legitimate national and/or regional quality label that is pertinent to that nation or region. The comparative advantage of disclosures is positively correlated with high-quality trademarks like geographic indications (Kos, 2018) [17]. The European Union (EU) developed quality schemes as a legislative tool to govern food ownership and control in the setting of international food markets (Vanhonacker, 2010) [31]. According to this viewpoint, products with a Protected Designation of Origin (PDO) and a Protected Geographical Indication (PGI) are the ideal match because the raw materials, production techniques, and technologies are all located in a specific geographic area with unmistakable natural elements.

A geographical indication is described as "...indications which identify goods originating in the territory or region of a member or from a location within its territory for a particular quality, reputation, or other characteristics. due to its geographical origin" (Pick, 2021; World Trade Organization) [22, 34]. This definition is found in Article 22 of the Trade Agreement on Intellectual Property Rights (TRIPS). This criterion ensures both the product's provenance and a specific level of quality. This characteristic is typically grouped with the French word terroir in Europe and refers to the presence of several regional variables (both environmental and human) (Cei, 2018) [8]. Geographical indications include designations such as "PGI - Geographical Indication" (for foods and alcoholic drinks) and "PDO - Protected Designation of Origin" (for foods and wine). Other quality certification programs place a stronger emphasis on conventional production techniques ("Traditional Specialty Guaranteed") or particular products made in arid or mountainous regions ("mountain products").

Table 1. PDO, PGI, GI, TSG Logos

| EU Quality Schemes | Logos |
|---|---|
| **PDO** | |
| **PGI** | |
| **GI** | |
| **TSG** | |

Source: European Commission [14].

The primary differences between PDO and IGP pertain to the quantity of raw materials utilized, which must be prevalent in at least

85% of the territory from where they come, as well as the production stages that must occur in the region under consideration. GI is typical for flavoured drinks and wines. By enabling producer organizations to mark and label the origin of their products, quality schemes offer a mechanism to safeguard the authenticity of conventional goods and prevent abuse and counterfeiting. By employing these logos (Table 1) to communicate to consumers the quality and attributes of their products, agricultural producers may assure fair competition, the protection of intellectual property rights, and an integrated internal market. They can reassure the customer that the products are authentic and not replicas or fakes by including a logo on the product packaging and charging a greater price than other foods in the same category. In Europe, many foods, drinks, and agricultural goods are certified by European quality systems (Glogovetan, 2022) [16]. Producers and their collective organizations must submit an application attesting to the connection between the product's quality traits and its geographical origin, as well as a product specification (PS) outlining the conditions that producers must meet in order to use the PDO/IGP mark, in order to register a PDO/PGI (Belletti, 2011; Marescotti, 2020) [3, 19]. As of now, the discrepancy in the number of certified products among the European Union's 28 members can be linked to the agricultural, cultural, and potential gastronomic history of each nation, but it is also a result of the financial aid schemes put in place for farmers (Stanciu, 2020) [28]. Data has been gathered to present a current situation regarding the number of agri-food items and alcoholic drinks registered in the member states of the European Union by accessing the eAmbrosia component of the EC website, more specifically the EU register of geographical indications. Statistics on the total number of agricultural foodstuffs and alcoholic beverages of guaranteed quality in each European Union nation are provided in Table 2. Data for alcoholic beverages and items with a "Registered" status up to February 14, 2023, was extracted.

The geographical distribution of approved foods and alcoholic beverages is highly focused towards southern Europe in the Mediterranean countries, as can be shown following the statistical analysis of the data gathered from eAmbrosia [13]. With a two-way tie for first place, Italy and France stand out, followed by Spain, Portugal, and Greece. The second finding is that TSG, with fewer items registered than PGI or PDO, is the principal authentication method for the majority of registered trademarks. PGI and PDO are the main authentication systems in terms of the quantity of food products registered.

Table 2. Number of agricultural products and alcoholic beverages registered until February 14, 2023

| **Country** | **Number of Agricultural Products and Foodstuffs Registered** | | **Number of Alcoholic Beverages Registered** | | |
|---|---|---|---|---|---|
| | **PDO/ PGI** | **TSG** | **PDO/ PGI** | **GI** | **TSG** |
| | | | **Wine** | **Spirit Drinks** | **Beers** |
| Austria | 16 | 3 | 28 | 10 | 0 |
| Belgium | 16 | 0 | 10 | 10 | 5 |
| Bulgaria | 3 | 6 | 54 | 12 | 0 |
| Croatia | 38 | 0 | 18 | 6 | 0 |
| Cyprus | 10 | 0 | 11 | 2 | 0 |
| Czechia | 30 | 1 | 13 | 0 | 0 |
| Denmark | 8 | 0 | 5 | 0 | 0 |
| Estonia | 1 | 0 | 0 | 1 | 0 |
| Finland | 8 | 3 | 0 | 2 | 1 |
| France | 260 | 2 | 438 | 53 | 0 |
| Germany | 93 | 0 | 45 | 36 | 0 |
| Greece | 115 | 0 | 147 | 15 | 0 |
| Hungary | 31 | 2 | 38 | 13 | 0 |
| Ireland | 8 | 0 | 0 | 3 | 0 |
| Italy | 315 | 4 | 526 | 34 | 0 |
| Latvia | 4 | 3 | 0 | 0 | 0 |
| Lithuania | 8 | 2 | 0 | 7 | 0 |
| Luxembourg | 2 | 0 | 1 | 0 | 0 |
| Malta | 0 | 0 | 3 | 0 | 0 |
| Netherlands | 11 | 4 | 19 | 5 | 0 |
| Poland | 34 | 10 | 0 | 2 | 0 |
| Portugal | 143 | 2 | 40 | 11 | 0 |
| Romania | 9 | 1 | 53 | 9 | 0 |
| Slovakia | 15 | 3 | 9 | 1 | 0 |
| Slovenia | 24 | 4 | 17 | 4 | 0 |
| Spain | 203 | 2 | 143 | 19 | 0 |
| Sweden | 10 | 0 | 0 | 3 | 0 |
| TOTAL | 1399 | 52 | 1618 | 258 | 6 |

Source: Author`s own interpretation based on eAmbrosia [13].

Finally, compared to agricultural food goods, alcoholic beverages, particularly wines, have the highest number of certifications in the European Union.

Alcoholic beverages account for a bigger number of certificates overall, including in the Mediterranean countries, as seen in the curve in Fig. 1 below. Romania is in a similar position.

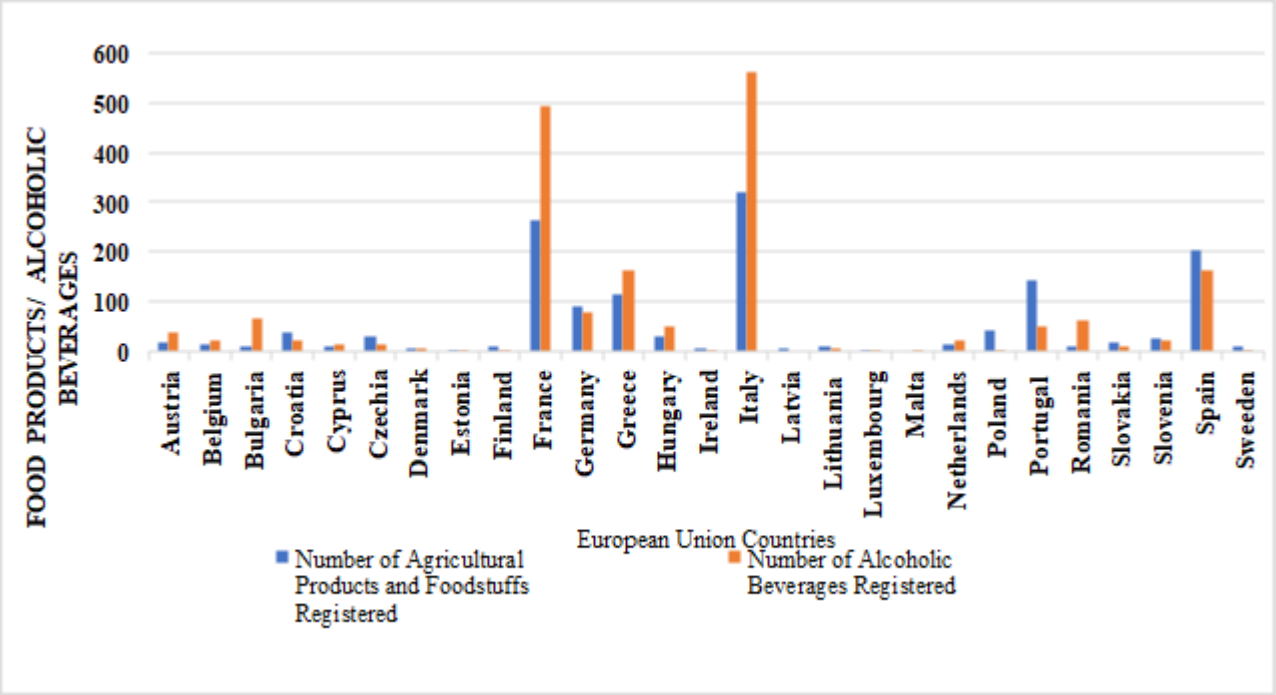


Fig. 1. The number of Agricultural Products compared to the number of Alcoholic Beverages Registered until February 14,2023.
Source: Author`s own interpretation based on eAmbrosia [13].

Romania joined the EU in 2007. Romania's agri-food products now have unfettered access to the EU single market and better access to international markets because there are no tariffs or export limitations. It also included unfettered access to the Romanian market for rival products made by other union members (Gavrilescu, 2016) [15]. Only 10 agricultural and food items in Romania are certified at the European level, according to eAmbrosia. The following is a list of Romanian agri-food products with EU certification.

Table 3. Romanian certified Agri-food products

| Food products Logo | Status | Product category | Certification Process traceability |
|---|---|---|---|
| **Magiunul de prune Topoloveni (PGI)**  **Producer: https://www.magiun-sonimpex.ro/** [30] | Registered | Class 1.6. Fruit, vegetables and cereals fresh or processed | -Date of application: 04/03/2009 -Date of publication: 08/09/2010 in the Official Journal C 241, 08.09.2010 -Date of registration: 08/04/2011 in the Official Journal L 94, 08.04.2011 |
| **Salam de Sibiu (PGI)** | Registered | Class 1.2. Meat products (cooked, salted, smoked, | -Date of application: 21/11/2014 |

| | | | |
|---|---|---|---|
|  **Producer:** **https://salamuldesibiu.ro/** [25] | | etc.) | -Date of publication: 06/10/2015 in the Official Journal C 329, 06.10.2015 -Date of registration: 19/02/2016 in the Official Journal L 44, 19.02.2016 |
| **Telemea de Ibăneşti (PDO)**  **Producer:** **https://mirdatod.ro/produse/**[21] | Registered | Class 1.3. Cheeses | -Date of application: 20/11/2013 -Date of publication: 10/01/2015 in the Official Journal C 6, 10.01.2015 -Date of registration: 15/03/2016 in the Official Journal L 68, 15.03.2016 |
| **Novac afumat din Ţara Bârsei (PGI)**  **Producer:** **https://www.doripesco.ro/[12]** | Registered | Class 1.7. Fresh fish, molluscs, and crustaceans and products derived there from | -Date of application: 20/11/2013 -Date of publication: 09/12/2016 in the Official Journal C 459, 09.12.2016 -Date of registration: 06/04/2017 in the Official Journal L 92, 06.04.2017 |
| **Scrumbie de Dunăre afumată (PGI)**  **Producer:** **https://deltaica.ro/[10]** | Registered | Class 1.7. Fresh fish, molluscs, and crustaceans and products derived therefrom | -Date of application: 26/10/2016 -Date of publication:08/05/2018 in the Official Journal C 162, 08.05.2018 Date of registration: 03/12/2018 in the Official Journal L 307, 03.12.2018 |
| **Cârnați de Pleșcoi (PGI)**  **Producer:** **https://www.carnatiplescoi.ro/[7]** | Registered | Class 1.2. Meat products (cooked, salted, smoked, etc.) | -Date of application: 04/07/2016 -Date of publication: 29/05/2019 in the Official Journal C 185, 29.05.2019 -Date of registration:04/10/2019 in the Official Journal L 255, 04.10.2019 |
| **Telemea de Sibiu (PGI)**  **Producer:** **https://telemeadesibiu.eu/[29]** | Registered | Class 1.3. Cheeses | -Date of application: 06/06/2018 -Date of publication: 17/06/2019 in the Official Journal C 203, 17.06.2019 -Date of registration: 16/10/2019 in the Official Journal L 263, 16.10.2019 |

| | | | |
|---|---|---|---|
| **Caşcaval de Săveni (PGI)**  **Producer:** https://vlasiecompany.ro/[33] | Registered | Class 1.3. Cheeses | -Date of application: 27/04/2017<br>-Date of publication: 16/01/2020 in the Official Journal C15 16.1.2020<br>-Date of registration: 22/04/2021 in the Official Journal L 137, 22.4.2021 |
| **Salată cu icre de ştiucă de Tulcea (PGI)**  **Producer: https://www.ropescador.org/[24]** | Registered | Class 1.7. Fresh fish, molluscs, and crustaceans and products derived therefrom | -Date of application: 06/07/2018<br>-Date of publication: 04/02/2021 in the Official Journal C 39, 4.2.2021<br>-Date of registration: 04/06/2021 in the Official Journal L 197, 4.6.2021 |
| **Salată tradiţională cu icre de crap (TSG)**  **Producer: https://www.ropescador.org/[24]** | Registered | Class 1.7. Fresh fish, molluscs, and crustaceans and products derived therefrom | -Date of application: 16/04/2019<br>-Date of publication: 11/06/2021 in the<br>-Date of registration: 29/09/2021 in the Official Journal L 344, 29.9.2021 |

Source: https://www.madr.ro/en/food-ind/european-quality-schemes-and-geographical-indications/agricultural-and-food-products.html [20].

This study intends to give an overview of the manner in which geographical indications are currently used in Romania and to highlight the importance of national certifications in the growth of the agri-food industry, with a focus on the certification initiatives that have been suggested by the AgroTransilvania Cluster.
The methodological considerations that aided in the creation of this research are described in Section 2. The key findings are described in part 3 followed by the concluding part in which the conclusions are drawn.

## MATERIALS AND METHODS

There are now voluntary certification programs in addition to the ones that were previously given. Customers can feel confident in the high standards of the products they purchase thanks to both government voluntary certification programs or those managed by private businesses. In addition to the EU programs, there are other commercial and national food quality schemes and logos that operate between businesses or between businesses and consumers and cover a wide range of projects. Following stakeholder consultation, the European Commission developed recommendations specifying best practices for the functioning of such systems (European Commission).
AgroTransilvania Cluster developed and expanded 4 certification schemes as an alternative to the European certification frameworks. Below is a description of the AgroTransilvania Cluster, whose history in the agri-food industry and activities served as the foundation for this study.

Fig. 3. AgroTransilvania Cluster Logo
Source: https://agrocluster.ro/[1].

On February 21, 2013, Asociatia Clusterul Agro-Food-Ind Napoca [1] became a legal entity. For a very long period, the idea of

creating an associative structure in this form has been around. Through sectoral meetings amongst prospective cluster members, both formally and informally, to discover shared interests and potential action plans, steady efforts have been taken towards its realization. There were 20 initial members at the time the association was founded.

To date in AgroTranslvania Cluster there are currently 81 members, as follows:

Table 4. The geographical distribution of AgroTranslvania Cluster members

| County | Number of members |
|---|---|
| Alba | 2 |
| Bihor | 3 |
| Bistrita Nasaud | 3 |
| Brasov | 2 |
| Bucuresti | 2 |
| Cluj | 61 |
| Hunedoara | 1 |
| Ilfov | 1 |
| Mures | 2 |
| Salaj | 1 |
| Satu Mare | 2 |
| Valcea | 1 |

Source: Authors' own development.

For a very long period, the idea of creating an associative structure in this form has been around. Through sectoral meetings amongst prospective cluster members, both formally and informally, to discover shared interests and potential action plans, steady efforts have been taken towards its realization. There were 20 initial members at the time the association was founded.

According to the AgroTransilvania Cluster statute, its members band together to promote the expansion of the agro-industrial sector. To accomplish the aim, the group members decided to develop and put into action a shared have the potential to be certified. Starting with the fact that there are only 10 agrifood products in Romania that have been granted European certification labels and taking into consideration the fact that there are multiple stages to the certification process for European certification schemes, the entire procedure approach.

The cornerstone of the association's development plan is the AgroTransilvania Cluster overarching goal and objective, which is to encourage the growth of the agro-industrial sector.

The goal of this purpose is to make the association and each individual member more competitive in both home and international markets.

The requirement to create national certification initiatives emerged from the necessity to find a solution for Romanian agri-food products that necessitates longer than applying for a national certification.


Fig. 4. AgroTransilvania Cluster certifications schemes
Source: Author`s own development.

## RESULTS AND DISCUSSIONS

In the following picture there are represented the proposals made by AgroTransilvania Cluster. In this research the focus is on these particular schemes: Pork Meat from Farms focusing on Swine Welfare and Local Product FermOras

**Pork Meat from Farms focusing on Swine Welfare**
**Issue addressed: Animal welfareand GoodAgriculturalPractices**


Fig. 5. Logo Pork Meat from Farms focusing on Swine Welfare
Source: AgroTransilvania Cluster [1].

Pork meat from pigs grown in welfare is a quality initiative based on the pig farming sector's use of animal welfare principles, and it allows interested parties to register/attest their fresh pork to the appropriate authority. The initiative is applicable to all producers and demands compliance to the product's mandatory technical specifications, which are independently verified by authorized government organizations. The initiative is transparent and it also guarantees complete product traceability. The voluntary labelling of fresh pork, including minced meat from pigs that have been raised in welfare, in accordance with the eligibility requirements, is permitted under the quality scheme - Pork Meat from Farms focusing on Swine Welfare also known as the *Scheme*. The producers of fresh pork, including minced pork (slaughterhouses, slaughterhouses, and mincemeat facilities), also referred to as Applicants, are the Scheme's intended beneficiaries. The scheme specifies out the requirements applicants must fulfill in order to be provided the certificate, in compliance with the technical quality requirements, and to be permitted to use the certification emblem on the product label. In accordance with the guidelines of the Pork Meat from Farms focusing on Swine Welfare scheme, MADR oversees the inspection and conformity assessment activity for the attestation of pork. The inspection's goal is to confirm that the qualifying requirements listed in this scheme's Annexe 1 are met. The report includes the inspection's findings. Monitoring activities will be carried out by the Applicant and by its pork suppliers in accordance with the self-control plans they have established in order to ensure traceability and verify the fulfilment of certification requirements for the main processes in the production stages, related to the growth, transport, slaughtering of pigs, slicing, portioning, and chopping of fresh meat from well-raised pigs.

**Local Product FermOras**
**Issue addressed: Environmental issues: protect the environment by reducing the carbon footprint (short supply chain)**


Fig. 6. Local Product FermOras
Source: AgroTransilvania Cluster [1].

Local Product FermOras is a voluntary quality initiative that makes it possible for producers and processors to certify their products in accordance with requirements based on the regional economy and the short supply chain.
The objectives of the scheme include:
-enhancing the local business climate; promoting social inclusion; protecting locally produced foods; and providing benefits to both customers and local producers/processors,
-building short supply chains that only include a few intermediaries.
-providing consumers with food which is produced using sustainable (local) methods,
-the disclosure of details about the manufacturer/processor and the food product,

particularly in regards to their superior qualities as viewed by the consumer as originating from the manufacturing procedures and particular ingredients associated to a geographic area,
-fair profit allocation along the food supply chain,
-enhancing marketing tactics to market regional food and agriculture products,
-increasing local producer inclusion in the food chain, shorter supply chains, and promotion of the circular economy
-new regional markets being developed in the framework of the circular economy,
-in light of the European Green Pact and the "Farm to Consumer" Strategy, safeguarding the environment through lowering carbon emissions (short supply chain),
-by generating new jobs in the agriculture and food production, direct sales, and allied industries, you are assisting the regional and local economy.

**Scheme specifications**

-The value of the main component originating in the defined area must be greater than 50% of the finished product's sales value.
-The submitting an application economic operator needs to be headquartered in the defined area.
-The operator will use a short food supply chain for marketing the finished product, with a maximum of one intermediary serving as the final consumer (local producer or processor associations, with or without legal personality, such as cooperatives or producer groups, will not be considered intermediaries).


Fig. 7. Designated area representation for Local Product FermOras Certification
Source: AgroTransilvania Cluster [1].

## CONCLUSIONS

Because there was no specialized market related to certified products in Romania in the early years after joining the EU, and because producers and consumers lacked sufficient information, there aren't many certifications that are recognized at the EU level in that country. When we talk about a lack of awareness, we imply that customers in Romania are still unable to link traditional methods with certification programs or labels, unlike in countries in South-West Europe where such traditions and food items are regarded as cultural heritage. The fact that applying for a certification scheme requires a number of steps and takes time is another factor that contributed to the low interest.
From the perspective of research and specialized literature, our advice is to gradually increase the number of publications on these topics; the best place to start is with studies that evaluate consumers' and producers' willingness to adopt certain certifications, as this will help raise awareness of the value of certifications from both groups. This might be viewed as a top-down strategy in which more people outside the research community should be involved. The key players in this process are the national government agencies and authorities, who must move quickly and decisively to change how Romanian manufacturers and consumers view the various European certification programs.

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# CLUSTERS EVOLUTION MODELS IN THE SCIENTIFIC LITERATURE: A TEXT MINING APPROACH

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***Abstract***

*The existing literature related to the cluster concept has been based on solid research from A. Marshall's theory of industrial districts to M. Porter's cluster concept, with location being the main factor on which the two built their premises. Considering that the cluster model has evolved over time, this paper aims to study the dynamism of this model, taking into account geographic concentration as an essential element influencing the emergence of clusters. Then it moves on to novel aspects, such as the role of clusters in promoting new technologies or innovations and the cluster's contribution to increasing the competitiveness of companies or even regional competitiveness. The methodological approach of this research consists in systematically reviewing the literature on clusters, the evolution of the model, the importance of geographical proximity and clusters' impact on growth, the elevation of innovation processes and competitiveness of companies and regions, but also the involvement of clusters in the implementation of policies. The paper provides a general picture of the dynamics of the concept by summarizing and integrating several concepts treated by other researchers in an in-depth manner. Our findings reveal the importance of the proximity factor for industries that are part of clusters, along with the fact that over time, globalization has imposed a trend towards an approach that crosses regional and national borders.*

***Key words*****:** *competitiveness, cluster policy, evolution, innovative clusters, regional development*

## INTRODUCTION

Clusters have been studied over time by both academics and public authorities. However, they have gained importance at a global level among policy-makers and the economic community, being considered facilitators between the public and private environment, and potential contributors to large-scale policy implementation (Ketels, 2008)[22].

Evidence of an early cluster concept was also features in the article, showing that industries were collaborating long before the concept was even introduced by Porter.

To begin, the cluster concept will be described from the standpoints of "industrial districts- an area where a concentration of firms has settled down" and "localized industry- an industry concentrated in certain localities", which Marshall introduced in 1920 (Belussi et al., 2008, p. 2) [1]. As can be seen, the starting point was closely related to the location of the companies and their tendency to cluster geographically, no matter the reason.

Building on the importance of the concentration of industries in a certain location, we introduce M. Porter's cluster concept 1998. "Clusters are geographic concentrations of interconnected companies and institutions in a particular field" (Porter, 1998; Kuath, 2002) [40, 24]. Based on the idea of concentrating resources in a certain proximity, M. Porter considers that the boundaries of the cluster are defined by links and complementarities between industries and in-situations that are most significant for competition (Porter, 1998; p. 79) [40]. Also, within the clusters there should be relations of both cooperation and competition (Porter, 1998; p. 81) [40]. To stress out this idea we bring to light Porter's diamond model which defines four essential dimensions for the development of clusters, namely: i) the initial regional sources; ii) the co-operation and competitiveness strategies of the companies in

the cluster iii) market conditions but also iv) relations with other markets/ industries operating in the same base market as the cluster (Boja, 2011; Rugman et al., 1993) [2, 42].

To better understand this collaboration and competition it is necessary to also bring to attention a cluster's architecture. From Porter's theory we can identify a series of basic composing elements such as suppliers of specialized inputs, suppliers of specialized infrastructure, customers, companies from industries operating in training human resources/skills, technologies or common inputs, but also the component of specialized institutions (public government, research institutions, universities and others that provide services, distinct from the field of activity) (Motoyama, 2008; Porter, 2000; Oprime et al., 2011) [32, 39, 36]. Going beyond the initial conditions necessary for the development of clusters, it can be said that important steps must be taken for cooperation, exchange of information and furthering innovation. The capitalization and transfer of knowledge can be achieved through co-operative relations between the economic, educational and government environments, the collaboration also known as the triple helix model (Etzkowitz, 2013; Leydesdorff, 2000; Safiullin et al., 2014; Leydesdorff et al .l, 2016; Cai et al., 2022) [10, 27, 44, 28, 3].

Due to the development of the global economy to a triple helix model, other factors have been introduced to meet these trends. As an extension to the previous concept, the media and cultural audiences as well as the civil society were also included in quadruple helix concept. The quintuple helix innovation model entails a more comprehensive approach, and also incorporates the natural environment of society (Reis et al., 2022; Carayannis et al. 2012; Carayannis et al., 2018) [41, 4, 5]. In the existing literature on the cluster concept, it can be seen that clusters have adapted to changes over time and have integrated these changes into the evolutionary model.

A notable contribution to the theoretical perspective on industrial clusters is the paper published by Bekele & Jackson, 2006, entitled "Theoretical perspectives on Industrial clusters," which analyzes the topic from the classic theories of agglomeration to dynamic externalities in a comprehensive way. According to their conclusions, there are a variety of theoretical concepts that attempt to explain the reasons for geo-graphical concentrations of economies. Among them is the fact that contemporary economies emphasize knowledge, especially the tacit exchange of information and knowledge within clustered industries (Gashawbeza et al., 2006) [16].

Furthermore, the paper notes that an assumed relationship between economic development and cluster industries has not been investigated in depth due to a lack of rigorous empirical evidence to support it. The problem is mainly due to the lack of theoretical and methodological frameworks for cluster analysis (Gashawbeza et al., 2006) [16].

Currently, policy makers consider that the existence of clusters in a certain region is correlated with a high degree of innovation, performance and employment out-comes (Gashawbeza et al., 2006, p. 9) [16]. In light of this, clusters are considered to be essential enablers in the transition to a green and digital environment. This approach gives clusters a triple purpose: i)to be sources of market information; ii) to develop of broker stakeholder networks and iii) to offer business support (Franco et al., 2021, p. 83) [11].

By taking into account the current priorities, both the global ones and those coming from the European Commission, clusters could play an important role in guiding innovation through sustainable processes. The transversal use of resources, through collaboration and knowledge transfer could bring the industries closer to a unitary approach. In certain industries, such as agriculture, there are innovation gaps in the social and institutional field, which demonstrates the need for better informing and a knowledge system able to deal with economic pressure and its evolution (Jitea et al., 2021) [20]. This relationship between industries is also possible due to the fact that we can observe this clustering

tendency in each industry (Pohulak-Zoledowska, 2008, p. 90) [38].

What remains is the promotion of collaboration, not only between the members of a cluster, but also collaboration between clusters in the same region and beyond.

In a global and continuously evolving market, society and the economic environment must identify a competitive advantage. Global competitiveness is achieved through increased productivity and a more focused and clearer direction. An increased and sustained pace of innovation and growth must also be maintained (Dayasindhu, 2002) [9].

Clusters have also the advantage of creating a favorable framework for knowledge exchanges, much-needed for the innovation process. Dynamics of clusters offer companies the premise of increased competitiveness by:

i) providing new companies with a frame-work of cooperation and stable connections;
ii) stimulating the diffusion of the new product and process technologies;
iii) guiding the updating and upgrading of companies through cooperation and competition;
iv) getting clusters involved in collective interventions (policies, trainings, research);
v) encouraging the directing of funds for the creation of collaboration networks (Simmie, 2004) [47].

The contributions analyzed above cover a series of different evolutionary stages in the history of clusters, and also offer a perspective on how they were able to adapt.

In terms of literature gap, it could also be observed that, as the cluster concept evolves and adapts to the changes occurring in society and the economy, the basic notions from which it started are no longer mentioned in the new published literature. This article counters this trend by reviewing what the core elements of the cluster concept mean and how it has taken on new tasks or acquired new roles in the economy.

Furthermore, the paper underlines the analysis of clusters as seen from the point of view of the academic environment and mainly examined according to three aspects cluster concept evolution, the importance of spatial distribution and clusters' in-evolvement in complex concepts such as innovation, competitiveness and policies.

The aim of this paper is to identify key elements that shaped cluster model evolution, focusing mainly on aspects as the dynamics of cluster' model, how clusters have evolved over time, spatial distribution as a key factor in the cluster emerge and operation, and clusters' more complex roles as innovators, competitiveness boosters, or technology promoters.

The main contribution of this study to the existing literature is a comprehensive review on the cluster concept, its applications, and theories of cluster adoption over time based on a systematic literature review, with a focus on spatiality and phenomena such as innovation, competitiveness, or clusters as key spillovers of new technologies.

This evolutionary approach addresses three important aspects that were included in the research questions.

*Research question 1*: Is there a specific way to define how the cluster concept has evolved over time, and if so, was this evolution agreed upon?

The aim is to identify the common thread in the description of the cluster model from various perspectives based on the data collected from the specialized literature. Identifying possible common perspectives and ideas regarding the cluster concept throughout time could lead us to claim that the cluster model followed a certain trajectory determined by a series of factors, which in their turn should be identified.

*Research question 2*: The spatial distribution of companies in a particular area is considered to be a key factor in cluster emergence, but was it seen as a key determinant?

This research question aims to probe whether the emergence of clusters chiefly depends on the agglomeration of companies in a certain area and whether the connection between the spatial component of companies and the formation of clusters, for-warded by Porter and other authors, is valid.

*Research question 3:* Can clusters be considered promoters of technological, innovative, policy and financial evolution over time?

This research question aims to identify whether clusters are a tool that has contributed to the evolution of the industries in which they have been active over time. We are talking here about technological evolution, adopters of innovations and deter-mining factors when it comes to the implementation of policies.

Regarding the new elements that the current work brings to the scientific environment, it can be mentioned that aspects that were treated separately by researchers in a more in-depth manner were included in the article by summarizing them. In this way the paper provides a general picture of the dynamics of the concept.

The current paper is organized as follows: a brief overview of the concept is pro-voided, along with information about the purpose of the study and the research questions.

Then, it is presented the research methodology, followed by a thematic synthesis of the results is presented, followed by some discussion around the results. Conclusions and limitations are drawn in the end of the article.

## MATERIALS AND METHODS

To answer the research questions presented above, a systematic literature review (SLR) was conducted.

The SLR is characterized by an in-depth literature search, as well as clear and easily understood searched terms and selection criteria (Ruhlandt, 2004) [43]. With the SLR methodology, relevant research can be identified and critically evaluated (Chifor et al., 2022) [6].

The existing literature on a certain topic can be reviewed for various reasons: from providing a foundation or evidence about a certain subject to finding out how reliable or possibly efficient a typology is (White et al., 2005) [52].

As an SLR is a thorough and rigorous research approach, this study began by screening the literature on the cluster concept and its evolution as a preliminary and exploratory step.

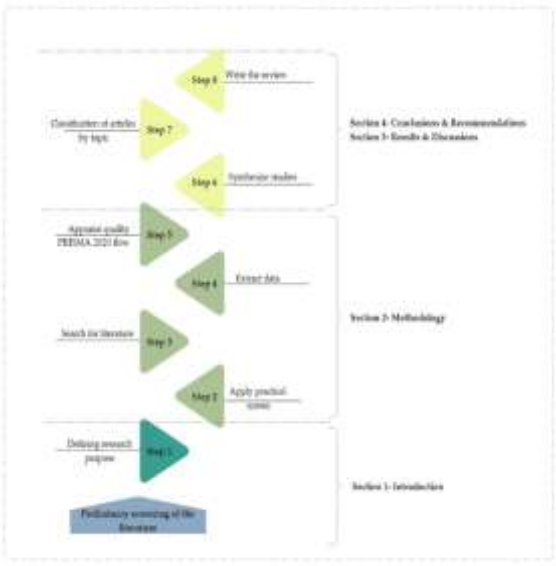

Fig. 1. Adapted systematic literature review steps by the authors
Source: Elaborated based from the steps proposed by Okoli (2015) [34].

SLR adopted the steps proposed by Chitu Okoli (2015) [34] with some personal adjustments by the authors.

The first step after examining the initial data was to:

1) define the purpose and the research questions (section 1- Introduction);
2) apply practical screen;
3) search for literature;
4) extract data;
5) appraise quality (section 2- Methodology);
6) synthesize studies;
7) classify the articles by topic;
8) write the review (section 3- Results & Discussions and section 4- Conclusions & Recommendations) (Okoli, 2015) [34].

Literature screening was performed by querying three prestigious academic literature databases, namely Web of Science, Science Direct and Scopus.

In step two of the practical screen, the categories related to the previously mentioned databases were defined in order to be included in the search (Table 1).

During step three, literature was searched by querying the database in two stages: in the first one a set of words was used and in the second one a novel combination of words was employed.

Table 1. Categories included in the databases search

| Web of Science | Scopus | Science Direct |
|---|---|---|
| Economics | Business, Management and Accounting | Business, Management and Accounting |
| Management | Economics, Econometrics and Finance | Economics, Econometrics and Finance |
| Business | Agricultural and Biological Sciences | Agricultural and Biological Sciences |
| Business Finance | | |
| Agriculture Multidisciplinary | | |
| Agricultural Economics Policy | | |
| Agricultural Engineering | | |

Source: authors own interpretation.

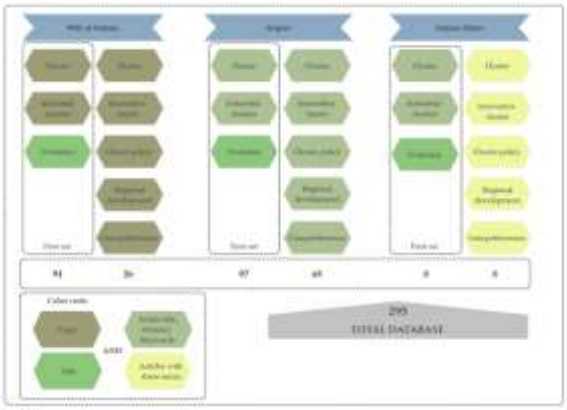

Fig. 2. Description of the inclusion criteria in the three databases
Source: authors own interpretation.

All literature was restricted to papers written in English. The results of the two sets of searches were put together in a common database (step four extract data). To adhere to the standards of systematic literature review, the implementation of a five step - appraise quality followed the process outlined in the PRISMA 2020 flow diagram.

PRISMA consisted of a four-phase flow diagram and a 27-item checklist. This describes the criteria for identification, screening, eligibility, and inclusion of publications within the scope of a certain evaluated topic (Selçuk, 2019) [46]. This way, the selection process is a transparent one and the decisions taken at the different stages of the flow are reported, including the reasons why certain exclusions were made (Onofre et al., 2021) [35].

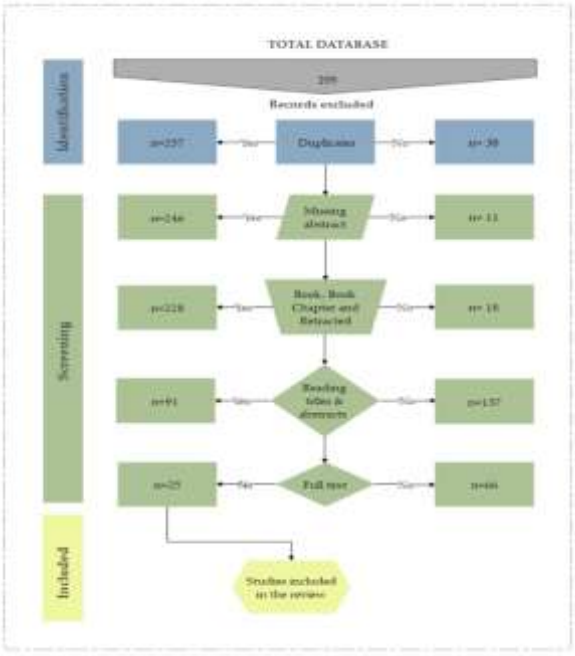


Fig. 3. PRISMA flow diagram
Source: Adapted by the authors based on the paper A Guide for Systematic Reviews: PRISMA by Selçuk (2019) [46].

After going through the filtering process presented in Figure 3, 25 relevant papers were included in the final sample. After reading the titles, abstracts and full papers, some literature was excluded on the following grounds:

1) it has only pre-print version;
2) the topic addressed does not fall within the scope of the current research;
3) the content was approached too widely and could not be included in one of the selected topics.

In the subsequent steps of study synthesis and articles classification by topic, all eligible publications were thoroughly examined, a synthesis of the content was carried out, and lastly the final articles were classified according to the categories presented in Table 2. A two-stage qualitative analysis was performed after reading the 25 full texts in order to better understand the subject: in the first stage a classification of the publications was made in chronological order, and at the same time, a classification was as-signed to the abovementioned papers among those presented in Table 3.

Table 2. Classification by topic and coding

| Category | Coding | Description |
|---|---|---|
| Life cycle Approach | 01 | It covers the topic related to the evolution of the cluster concept from the life cycle perspective. |
| Location | 02 | Details on the agglomeration of SMEs, external economies, concentration (in space), proximity of cluster members, local economies, and local accumulation |
| Innovation | 03 | It includes all issues related to innovation within the clusters and the companies in their component, as well as the regional innovation impact. |
| Policy | 04 | Notions of the policy through which clusters and policies related to the implementation of certain priorities have formed and evolved; clusters as determinants in the implementation of large-scale policies. |
| Network | 05 | All data related to the cooperation inside and outside the cluster is included, the way in which these connections have evolved and an overview of their impact. |
| Knowledge sharing | 06 | Clusters as knowledge spillovers; the way this knowledge flow is achieved. |
| Competitiveness | 07 | Evidence related to strengthening competitiveness at both company and regional level. |

Source: authors own interpretation.

The second stage consisted in synthesizing the information according to the classification that it was assigned. It is important to mention that a publication could have been assigned to more than one coding due to the diversity of the topic addressed and the results it contained. All the above processes allowed the authors a better understanding of the concept, along with a classification of the evolution and also provided answers for the research questions. After completing the steps described above, the results were disseminated in the following sections.

## RESULTS AND DISCUSSIONS

After completing all the steps presented in the previously explained methodology, a number of 25 articles remained relevant for the evolutionary analysis of the clusters.

The analysis of the results was divided into two parts. In the first one, the papers were analyzed from a chronological perspective and at the same time, based on the central ideas on which the work was built, they were framed in a codification. The second part focused on the analysis of the main ideas addressed. We begin by looking at clusters from a classification perspective as it is represented in Table 3.

Table 3. Studies included in the systematic literature review ordered chronologically and coded according to the focal points

| Authors | Title | Year | Classification | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 01 | 02 | 03 | 04 | 05 | 06 | 07 |
| D. Keeble; Wilkinson, F. (Keeble et al., 2021)[21] | Collective Learning and Knowledge Development in the Evolution of Regional Clusters of High Technology SMEs in Europe | 1999 | | X | X | | | X | |
| Yamawaki, H. (Yamawaki, 2002) )[53] | The Evolution and Structure of Industrial Clusters in Japan | 2002 | | | X | | X | X | |
| Guerrieri, P.; Pietrobelli, C. (Guerrieri et al, 2004) )[17] | Industrial districts' evolution and technological regimes: Italy and Taiwan | 2004 | | X | | | X | X | |
| Fromhold-Eisebith, M.; Günter, E. (Fromhold-Eisebith et al, 2005) )[12] | How to institutionalize innovative clusters? Comparing explicit top-down and implicit bottom-up approaches | 2005 | X | | | X | | | |
| Iammarino, S.; McCann, P. (Iammarino et al., 2006) )[19] | The structure and evolution of industrial clusters: Transactions, technology and knowledge spillovers | 2006 | | X | | | | | X |
| Su, Y.S.; Hung, L.C. (Su et al., 2008) )[48] | Spontaneous vs. policy-driven: The origin and evolution of the biotechnology cluster | 2008 | X | | | X | X | | |
| Cruz, S.C.S.; Teixeira, A.A.C. (Criuz et al, 2010) [7] | The Evolution of the Cluster Literature: Shedding Light on the Regional Studies-Regional Science Debate | 2010 | | | | | | X | |
| Menzel, M.P.; Fornahl, D. (menzel et al., 2010) )[31] | Cluster life cycles-dimensions and rationales of cluster evolution | 2010 | X | X | | | | X | |
| Martin, R.; Sunley, P. (Martin et al., 2011) )[30] | Conceptualizing Cluster Evolution: Beyond the Life Cycle Model? | 2011 | X | | X | | X | | |
| Wang, T. (Wang, 2011) [51] | Does geographical proximity matter in evolution of industrial clusters? | 2011 | | X | | | | | |

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|---|---|---|---|---|---|---|---|---|
| Lin, H.M. (Lin, 2012) [29] | The dynamic evolution and technological diffusion in Taiwan's TFT-LCD industrial cluster: a network perspective | 2012 | | X | | X | | |
| Cui, X.; Wu, B. (Cui et al., 2013) [8] | Regional Innovation System Based on Industrial Clusters | 2013 | | X | | | X | |
| Fundeanu, D.D.; Badele, C.S. (Fundenua et al, 2014) [13] | The impact of regional innovative clusters on competitiveness | 2014 | | | | X | X | X |
| Gafurov, I.R.; Platonova, O.U.; Pratchenko, O.V. (Gafurov et al, 2014) [15] | New state economic policy - Cluster policy cluster policy as the factor of innovative development of Europe | 2014 | | | X | X | | |
| Păuna, C.B. (Pauna, 2015) [37] | Cross-sectoral Cooperation vs. Cluster Development at European Level | 2015 | | | X | | | |
| Fundeanu, D.D. (Fundeanu, 2013) [14] | Innovative Regional Cluster, Model of Tourism Development | 2015 | | | | X | | |
| Valdaliso, J.M.; Elola, A.; Franco, S. (Valdaliso et al, 2016) [50] | Do clusters follow the industry life cycle?: Diversity of cluster evolution in old industrial regions | 2016 | X | | | X | X | |
| Yang, Z.S.; Dunford, M. (Yang et al, 2017) [54] | Cluster evolution and urban industrial dynamics in the transition from a planned to a socialist market economy: the case of Beijing | 2017 | X | | | | | |
| Halse, L.L. (Halse, 2017) [18] | The evolution and transformation of industrial clusters: A conceptual model | 2017 | X | | | | | |
| Zedgenizova, I.; Ignatyeva, I. (Zedgenizova et ll, 2017) [55] | The Problems of Creation and the Prospects for Development of Regional Clusters | 2017 | | | | | | X |
| Lehmann, E.E.; Menter, M. (Lehmann et al, 2018) [26] | Public cluster policy and performance | 2018 | | | X | X | | |
| Nikonova, T.V.; Yusupova, L.M.; Kodolova, I.A.; Kalimullina, R.R. (Nikonova et al, 2018) [33] | Cluster Approach as a Factor of Increasing the Investment Attractiveness of the Region | 2018 | | | | X | | |
| Konstantynova, A. (Konstantynova, 2019) [23] | Cluster policy change and evolution: facilitating regional smart specialisation and economic development | 2019 | | | X | | | |
| Scutaru, L.; Prelipcean, G.; Cozorici, A.-N. (Scutaru et al., 2019) [45] | Smart Specialization in Supporting SMES in the Tourism Sector Through Innovative Clusters | 2019 | | | X | | | |
| Laiko, O.; Kovalenko, S.; Bilousov, O. (Laiko et al., 2020) [25] | Prospects for the Development of Cluster Forms of Entrepreneurship In Euroregions | 2020 | | X | | X | | X |

Source: Authors' synthesis based on [21, 53, 17, 12, 19, 48, 7, 31, 30, 51, 29, 8, 13, 15, 37, 14, 50, 54, 18, 55, 26, 33, 23, 45, 25].

Taking a closer look at the main area of interest, the most widespread topic related to the cluster is the network, more precisely the relationship between the members of the cluster followed by policy and innovation.
Looking more in-depth, Table 4 highlights the works included in the research with the description of the main ideas approached in a classified manner.

Table 4. The main ideas classified according to the coding presented in Table 2

| Authors | Code | Main ideas |
|---|---|---|
| Keeble, D.; Wilkinson, F. (Keeble et al., 1999) [21] | 02 | Companies located in close proximity to one other can benefit much more easily from the technological and organizational developments generated on a large scale (p. 4). |
| | 03 | There is a direct relationship between the labor turnover and the radical product integration given by the idea of collective learning. There is also a relationship between incremental product innovation and proximity to the workforce (p. 8). |
| | 06 | The ability to share and use diverse knowledge was seen as an important precondition for the success of high-tech regions- collective learning perspective (p. 7). |
| Yamawaki, H. (Yamawaki, 2002) [53] | 02 | The existence of specialized supportin a localindustry is considered the most important element in creating agglomeration economies (p. 19). |
| | 05 | The knowledge flow is realized in a natural way within a strengthened network (p. 19). |
| | 06 | The complementarity of the capabilities (skills, knowledge, labor) of the entities in the cluster and the exchange of knowledge between them constitute an asset in the evolution of clusters (p. 19). |
| Guerrieri, P.; Pietrobelli, C. (Guerrieri et al., 2004) [17] | 02 | Globalization has changed the paradigm for both the concept of proximity, quality and scope of competition (p. 13). |
| | 05 | For survival, local and global visibility are needed, along with global networks that allow the accumulation of knowledge (p. 13). |
| | 06 | The knowledge transfer crosses the cluster borders and it is important for it to be achieved globally (p. 13). |
| Fromhold-Eisebith, M.; Günter, E. (Fromhold- | 01 | Regarding the phases of the cluster life cycle strategic public efforts can be a way to help the cluster in the early stages when there is a need to increase the degree of awareness within included organizations (p. 17). |
| | 04 | There is not enough evidence to support either the top-down or bottom-up approach as having superior advantages (p. 16). |

| | | |
|---|---|---|
| Eisebith et al, 2005) [12] | | |
| Iammarino, S.; McCann, P. (Iammarino et al., 2006) [19] | 02 | Innovators chiefly appear where the technological opportunities are the greatest, therefore they will tend to concentrate geographically, raising emerging clusters (p. 15). |
| | 07 | Companies may consider that by sharing knowledge of the economic environment (outflow), they lose their competitive advantage over their competitors (p. 7). |
| Su, Y.S.; Hung, L.C. (Su et al., 2009) [48] | 01 | From the life cycle perspective of an industrial cluster, it can be seen that there is no clear recipe regarding the modeling of a cluster. Both spontaneously formed clusters that operate in an organic way and policy-driven clusters evolve in a dynamic way influenced by the stage of development (p. 10). |
| | 04 | Policy-driven clusters seemed to enjoy greater financial support and human capital, while those created spontaneously seemed to exceedwhen it came to the entrepreneurial spirit with which they were led (p. 9). |
| | 05 | The network pattern showed that when it came to collaboration, spontaneous/ organic clusters moved towards closer connections between companies, while policy-driven clusters strengthened the relationships built between companies and the government (p. 10). |
| Cruz, S.C.S.; Teixeira, A.A.C. (Cruz et al., 2010) [7] | 06 | The trends in the specialized literature regarding clusters show an emphasis on knowledge spillovers, as well as the importance of social networks and the interactions of firms in the dissemination of information and the production of innovations (p. 18). |
| Menzel, M.P.; Fornahl, D. (Menzel et al., 2010) [31] | 01 | The cluster life cycle does not overlap with the life cycle of the industry in which it operates; it is not based only on quantitative data but also on qualitative aspects such as the diversity, heterogeneity and knowledge of the companies (p. 24). |
| | 02 | The closer the collaboration between companies in the cluster, the greater the technological and knowledge absorption capacity of the companies is (p. 26). |
| | 06 | In order to create certain differences between the clusters companies an essential stage is the sustainability of the cluster. Promoting linkages with other knowledge flows outside the cluster can create new technological distances, thereby maintaining these important differences (p. 27). |
| Martin, R.; Sunley, P. (Martin et al., 2011) [30] | 01 | There is an essential component that impacts the growth and decline of a cluster, independent of the industry-specific life cycle. This refers to the use of different competences that differ between grouped and ungrouped firms (p. 5). |
| | 03 | As the technology-industry life cycle matures, the cluster's initial advantages gradually become disadvantages, and the industries that lean toward innovations and the spread of innovations become important in the process (p. 4). |
| | 05 | The common components of a cluster are the types of relationships between firms or members of the cluster (system), network interactions, interdependence (p. 7). |
| Wang, T. (Wang, 2011) [51] | 02 | For companies reacting either competitively or cooperatively, proximity is a necessary condition for industrial development clusters (p. 4). |
| Lin, H.M. (Lin, 2012) [29] | 03 | When innovation is a priority, one could observe the tendency of companies to imitate other companies with which they compete and also look for their cooperative behavior (p. 11). |
| | 05 | Technology transfer occurs mostly among connected firms because they share knowledge and tacit learning (p. 11). |
| Cui, X.; Wu, B. (Cui et al., 2013) [8] | 03 | The advantages of an industrial cluster include its innovative effect, given that it in itself is actually a special innovation system (p. 7). |
| | 06 | Clusters help and promote innovation by creating the necessary innovation framework, cultivating enterprise learning and promoting the transfer of knowledge, thus being a facilitator of innovation (p. 3). |
| Fundeanu, D.D.; Badele, C.S. (Fundeanu et al., 2014) [13] | 05 | By joining a network whose purpose is to gather expertise and to stimulate the competitiveness of its component entities, companies will be able to follow the effects that this fact generates by evaluating their own resources (p. 10). |
| | 06 | Clusters can have an impact on the economy, competitiveness and innovation as being considered links between the economic environment, research and public authorities and policy makers (p. 10). |
| | 07 | When we talk about the impact of clusters at a regional level, it can be said that they influence competitiveness by creating new jobs, attracting investments, implementing public policies and stimulating entrepreneurship (p. 8). |
| Gafurov, I.R.; Platonova, O.U.; Pratchenko, O.V. (Gafurov et al., 2014) [15] | 04 | Practice has shown that innovation policy is impossible without stable links between industrial groups, higher education institutions and scientific institutions, economic institutions. It could also be observed from practice that, innovative activity unites them (p. 3). |
| | 05 | Based on good practical examples of the countries and territories that are the global epicenters of the generation of innovations, it can be observed that the transition of economic systems to the new growth model begins with the creation of a cluster network environment (p. 3). |
| Păuna, C.B. (Pauna, 2015) [37] | 04 | Research on cluster policies indicates that there are basically two types of policies, namely i) emergent policies which support existing clusters in the development phase or clusters in formation and ii) policies that use information about how industrial development is evolving to develop new policies (p. 3). |
| Fundeanu, D.D. (Fundeanu, 2013) [14] | 05 | In order to obtain individual benefits, the members of the cluster are in a symbiotic relationship of cooperation but also in competition (p. 3- p. 5). |
| Valdaliso, J.M.; Elola, A.; Franco, S. (Valdaliso et al., 2016) [59] | 01 | Technology and industry play a significant role in the evolution of clusters as it tend to co-evolve with their dominant industry. If the industry stalls, it either follows the course of the industry, or it transforms radically. If the industry changes at a fast pace, it either evolves with the industry at the same pace, or remains stuck, and in the end, decline will occur (p. 16). |
| | 05 | The larger the cluster, knowledge base and region, the greater the cluster's ability to adapt to changes in the industry (p. 17). |
| | 06 | The knowledge base of the cluster depends on |

| | | |
|---|---|---|
| | | the capabilities (and strategies) of member companies, the absorptive capacity of the clusters, the ability to create networks plus the adding capabilities of the region (p. 14). |
| Yang, Z.S.; Dunford, M. (Yang et al., 2017) [54] | 01 | The evolution of the cluster can be affected both by internal factors related to the links between companies, but also by external factors such as globalization, which offer the opportunity of upgrading and generating a significant structural adjustment (p. 16). |
| Halse, L.L. (Halse, 2017) [18] | 01 | The proposed cluster model shows that the macroculture of the clusters, over time, will be influenced by changes at the transactional level and that the new relationships between companies will prevail and the exchange of knowledge will be done explicitly not tacitly (p. 13). |
| Zedgenizova, I.; Ignatyeva, I. (Zedgenizova et al. 2017) [55] | 07 | Through clusters, regions can be offered numerous advantages, the beneficiaries mainly being manufacturing enterprises, businesses, the government and educational institutions and other actors that will have the opportunity to work together to increase and strengthen competitiveness and the production potential of the region (p. 17). |
| Lehmann, E.E.; Menter, M. (Lehmann et al., 2018) [26] | 04 | The creation of industrial clusters constitutes an effective and appropriate political tool for regional promotion, especially for structurally weak regions. They can profit from industrial agglomerations that focus on future markets to compensate regional disadvantages (p. 28). |
| | 05 | The public policies of clusters could promote increased collaboration between university-industry-government and could also have an impact on new companies, thus resulting in a vibrant business environment with economic impact at the regional level (p. 28). |
| Nikonova, T.V.; Yusupova, L.M.; Kodolova, I.A.; Kalimullina, R.R. (Nikonova et al., 2018) [33] | 05 | Clustering is also important for regional management, clusters being among the most progressive and modern industrial policy models, an effective enabler for building business networks, including business-to-government networks (p. 4). |
| Konstantynova, A. (Konstantynova, 2019) [23] | 04 | The best practice examples have shown that cluster policies must be flexible and adaptable to truly generate positive change to a certain region (p. 9). |
| Scutaru, L.; Prelipcean, G.; Cozorici, A.-N. (Scutaru et al., 2019) [45] | 04 | The idea of clustering and cooperation between clusters is promoted for the implementation of policies related to smart specialization regions (p. 12). |
| Laiko, O.; Kovalenko, S.; Bilousov, O. (Laiko et al., 2020) [29] | 03 | On a global level, it can be observed that clustering of cross-border economies influences competitiveness, also boosting and improving innovative activities (p. 4). |
| | 05 | Enterprises that are part of a cluster earn extra synergistic effect due to the use of shared resources as technologies, infrastructure and market infrastructure and spheres of activities (p. 5). |
| | 07 | The cluster framework also generates an additional economic effect with impact on improving competitiveness advantages the region (p. 4). |

Source: Authors' synthesis based on [21, 53, 17, 12, 19, 48, 7, 31, 30, 51, 29, 8, 13, 15, 37, 14, 50, 54, 18, 55, 26, 33, 23, 45, 25].

Going into further detail on the characteristics of the various papers, from the SLR carried out within the present research we can highlight seven focal areas:

***1. Life cycle***

With respect to the cluster life cycle, the idea that seems to be accepted and pro-moted is that there is no unanimously valid model of how clusters evolve from the life cycle perspective. Rather, it is about how they adopt the changes that occur both internally and externally (Fromhold-Eisebith, 2005; Su et al., 2009; Menzel et al., 2010; Martin et al., 2011; Valdaliso et al., 2016; Yang et al., 2017; Halse, 2017) [12, 48, 31, 30, 50, 54, 18].

Opposing ideas can be observed regarding the relationship between the cluster life cycle and the industry life cycle in which it operates.

In the work published by Valdaliso, J.M.; Elola, A.; Franco, S. (Valdaliso, 2016) [50], it is mentioned that technology and industry play a significant role in how clusters evolve and tend to co-evolve with the industry. Authors Menzel, M.P.; Fornahl, D. (Menzel et al., 2010) [31] argue that there are essential components that have an impact on the growth or decline of a cluster. Those are independent of the industry life cycle. Future studies need to be done to address this exhaustive idea.

***2. Location***

The location or proximity of a cluster is considered by many (Keeble et al.,1999; Fromhold-Eisebithet al., 2005; Yamawaki, 2002; Menzel et al., 2010; Tao, 2011) [21, 12, 53, 31, 49], an influential factor in its functioning. Being concentrated in an area generates benefits such as the adoption of new technologies, innovation, specialized support, and the ability to absorb new knowledge or innovations.

A trend could be observed in opposition to those previously mentioned in the publication by Guerrieri, P.; Pietrobelli, C. (2004) (Guerrieri, et al., 2004) [17] who argue that globalization has changed the paradigm and localization may not be a decisive factor for firms that want to expand beyond regional clusters.

***3. Innovation***

In the case of innovation, clusters positively influence companies by guiding them towards innovation, whether it is collective learning or innovation forced by competition (Keeble et al., 1999; Martin et al., 2011; Lin 2012; Cui et al., 2021; Laiko et al., 2020) [21, 30, 29, 8, 25].

***4. Policy***

Concerning the policies, the papers consulted focused more on clusters' policies, from emergence to operation (Fromhold-Eisebith et al., 2005; Su et al., 2009; Pauna, 2015; Konstantynova, 2019) [12, 48, 37, 23 ].

As facilitators or promoters of the implementation of certain policies, clusters could be involved in the completion of innovative policies and those related to smart specialization regions (Fundeanu, 2014; Lehmann et al., 2018; Scutaru et al., 2016) [13, 26, 45].

***5. Network***

It can be said that the creation of complex networks is encouraged both within the cluster and outside of it, including at global level. In addition to building networks, network flow is also promoted (Yamawaki, 2002; Guerrieri 17, 48, et al., 2004; Knowledge 2009; Martin et al., 2011; Lin, 2012; Fundeanu et al., 2013, Gafurov et al., 2014; Fundeanu, 2014; Valdaliso et al., 2016; Lehmann et al., 2018; Nikonova et al., 2018; Laiko et al., 2020) [53, 17, 30, 29, 14, 15, 13, 50, 26, 33, 25].

***6. Knowledge sharing***

As a result of knowledge sharing, clusters can be viewed as having spillover effects on the spreading of information (Keeble et al. 1999; Cruz et al., 2010; Cui et al., 2012; Fundeanu et al., 2013; Valdaliso et al., 2016) [21, 7, 8, 14, 50]. Additionally, information regarding the diversity of knowledge could be extracted. In order to keep the cluster and the region on a dynamic development path, it is essential to foster complementary learning and information exchange outside of territorial boundaries (Yamawaki, 2002; Guerrieri et al., 2004; Menzel et al., 2010) [53, 17, 31].

***7. Competitiveness***

A functional framework of competitiveness can be attributed to clusters. Moreover, they have a significant impact on the competitiveness of a company on a national, regional, and global level (Fundeanu et al., 2013; Zedgenizova et al., 2029; Laiko et al., 2020) [14, 55, 25]. In addition, companies may find that sharing knowledge, interacting with other companies in the cluster, which are usually direct competitors, removes their competitive advantage (Iammarino et al., 2006) [19].

Creating a collaborative and competitive environment built on trust could help companies feel safe as part of such a complex structure.

Summarizing all the main ideas mentioned above, it is necessary to emphasize the fact that clusters have been studied in a complex manner, from their life cycle evolution to broader concepts such as innovation, knowledge, relationships and competitiveness, being associated credits in those directions.

With reference to the research questions, there is no single recipe to show how the clusters evolve (RQ1), but there are certain factors that determine the trajectory as the emergent polices, connections formed in the cluster, network, knowledge sharing, and their internal and external (regional) capacities.

Proximity gives obvious advantages to form networks, and it is important for the exchange of knowledge between them (RQ2). The fact that they operate in a free market determines the need to have a global approach such as internationalization, cross-border cooperation and relations with other entities outside the cluster (Guerrieri et al., 2004) [17].

Clusters have been and are considered key drivers in the adoption of new technologies and promotion among members. They have been involved in large-scale policy implementation and are an essential promoter of innovation (RQ3).

Having considered the sources interrogated for this study, it can be said that in addition to the information that is required to answer the research questions, other common findings were identified. There is an impact regarding competitiveness and additional economic effect of both clustered-companies and the regions where they are formed (Laiko et al., 2020) [25]. This impact of clusters on regional development can be observed in more current research. If in the works of Bekele & Jackson, 2006 we could observe that industrial agglomerations could not be attributed the premise that they contribute to the development of a region, in more recent studies we can observe the tendency to link regional competitiveness and regional development with the functioning of a cluster in that area (Gashawbeza et al., 2006)[16].

## CONCLUSIONS

Briefly, clusters have an impact on the increase of competitiveness of both companies and regions. The more mature and cooperation-oriented the transfer of knowledge from inside and outside the cluster is, the more this informational and knowledge flow has a significant impact. In the current economic context, which is no longer a closed and regionally blocked system, clusters can be a strong link between regional economies and similar global economies in terms of adopters of new innovations, transfer of knowledge in both directions inside and outside the cluster. Clusters can also be used as the main entities responsible for the implementation of policies applied on a large scale, an advantage given by the connections and networks they include.

A suitable approach might involve defining a cluster model that takes into ac-count the cluster's life cycle. This will enable us to determine the cluster's operating direction based on the cluster's components at a particular time. It is important to note that if the members who initially directed the action in the component of a cluster have either withdrawn or are technologically outdone, or if the new companies in the cluster are innovative or making technological advances, then the cluster itself must adapt its strategy in accordance with the directions given by that group of active and relevant companies in the cluster. The current work, based on the data obtained and analyzed, contributes to the specialized literature by offering some perspectives on how clusters and their attributes have evolved in the economy.

This study has several limitations that should be considered when evaluating its results. As a starting point, papers were gathered from only three databases: Scopus, Science Direct, and Web of Science. Furthermore, it was observed that varieties often used to describe clusters, such as geographical agglomerations, economic concentrations, and special economic zones were not included in the combinations of words chosen to gather the specialized literature. Thirdly, because of the search criteria, papers published in other languages were excluded.

In terms of exhaustiveness, this review could have been more comprehensive if other databases had been queried or if other sets of words and languages had been included.

The current paper was based on a synthesis of the literature covering a complex concept, it is clear that the current paper does not delve deeper into the concepts, but provides an overview of the dynamics of the cluster concept being evaluated in an evolutionary perspective. On the other hand, what was found could also be applicable in other fields.

Further research could also focus on studying the interconnectivity between clusters operating in the same region, even if the industries they operate in are different, to see if geographic proximity is indeed an impact factor.

To deepen, a study on the relationship between the theory of industrial organization and the impact that clusters have on the strategic decisions that companies make could constitute another future research direction.

The data related to the influence of clusters on increasing competitiveness are empirical and a more in-depth analysis based on a quantitative analysis that includes various criteria, from economic performance to visibility or even customer loyalty, would be recommended. Also, a study that is based on a wider evolution over time.

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# RESEARCH ON CLUSTERING CONDITIONS IN SOUTH AFRICA

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***Abstract***

*Initially, clusters focused on creating a framework for cooperation between economic actors, research institutes, and public authorities from the same geographical concentration. Considering the European cluster model as a way of developing solid cooperation, the same steps were presented to find the interest of South African's economic actors in developing a feasible partnership model. This includes analyses on a wider scale, such as the degree of development of the compared countries where the model was implemented, the particularities and political priorities, the fields of activity. Going forward, the next steps that can be done are: mapping the existing clusters and their operating characteristics, assessing the regional business environments and the degree of competitiveness. After carrying out the analysis, there is concern about whether this concept can be implemented in countries like South Africa. Additional investigation will focus on other elements that affect the model's successful application.*

***Key words*****:** *clusters, competitiveness, cooperation, environment, impact, South Africa model*

## INTRODUCTION

The links created between players in the same industry or between various industries are shifting as a result of constant dynamism and change, along with the borders of those industries.

Some industries experience such intense competition because of how interconnected they are. The biggest problem today might be to figure out ways or procedures that could be used to assist economic actors in becoming more creative and competitive in such a dynamic global market (European Commission- European Observatory for Clusters and Industrial Change, 2019) [16].

At the European level, industrial clusters may be an effective economic and regional support instrument. The European Cluster Collaboration Platform (ECCP) describes industrial clusters as "geographical concentrations of firms and other actors working in related spheres of economic activity, such as Sectoral Industries and Industrial Ecosystems [6].

Clusters are a significant component of the European industrial landscape, according to the European Expert Group on Clusters - Recommendation Report [9]. In 2020, there were 2,950 regional industrial clusters, which accounted for almost every fourth job in Europe (61.8 million jobs, or 23.4% of all employment) and roughly half of employment in exporting industries (50.3%) [10, 17] (European Commission- European Observatory for Clusters and Industrial Change, 2020) [17].

Theoretically and empirically, clustering is beneficial for businesses and regions, which is why it has been widely used in the field of economic framework development.

Clusters are a component of a more comprehensive conceptual framework for comprehending factors that affect regional and national competitiveness. This approach, which is based on the paper named Competitive Advantage of Nations by Michael E. Porter (1990) [29], established a connection between firm-level conduct and economic policy at both the micro and macroeconomic levels (European Commission- Europe INNOVA, 2007) [11, 12].

Industrial clusters can provide a compelling paradigm for municipal and state leaders to evaluate and sustain the economies they lead. The value of clusters was recognized at the European level, and the EU established the EU cluster policy to put this understanding into practice by using clusters to carry out

European priorities. The following table emphasizes the role played by the Clusters in carrying out the priorities settled on at the European level.

Table 1. The integration of clusters to carry out of EU actions

| EU CLUSTER ACTIONS | |
|---|---|
| **Definition/ Purpose** | **Key points** |
| **EUROCLUSTERS** | |
| Industry clusters and other economic actors are gathered by cross-sectoral, interdisciplinary, and trans-European strategic initiatives known as euroclusters. | ∇ Carry out the industrial policy of the EU<br>∇ Develop novel opportunities for SMEs<br>∇ Successfully integrate SMEs into global and European strategic value chains. |
| **European cluster partnerships** | |
| The goal of launching European cluster partnerships was to enhance cooperation between regions and industries. | ∇ Take initiatives for the benefit of their SME members as a whole;<br>∇ Boost economic growth and competitiveness in Europe;<br>Type of European cluster partnerships:<br>1.Innovation (INNOSUP) [11]<br>2.International (ESCP-4i)[13]<br>3.Excellence (ESCP-4x) [14]<br>4.Smart Specialisation (ESCP-s3) [15] |
| **ClusterXchange** | |
| This is an exchange program for clusters, SMEs and scale-up support organizations. | ∇ Support short-term exchanges to better connect industrial ecosystems in Europe<br>∇ Facilitates transnational cooperation, peer learning, networking and innovation |
| **European Clusters Excellence** | |
| Promotes the excellence of cluster organizations and the services they offer | ∇ Cluster benchmarking methodology<br>∇ Quality of cluster organisations' management |

Source: European Commission [18].

The afore mentioned initiatives represent some of the programs in which the clusters have participated over time, contributing significantly to the growth of the industrial ecosystem. In addition to these, the European Commission claims that a number of other actions have been implemented using clusters as:

∇ **The European Cluster Collaboration Platform-** serves as a European virtual hub for industrial clusters [18, 19]:

◊ tracks cluster activity;

◊ offers specialist assistance to clusters;

◊ organizes matchmaking activities and events.

∇ The initiative called "**Advanced Technologies for Industry**" (**ATI**) keeps methodically checks on technological advancements and disseminates accurate and up-to-date information on these technologies [18, 19]:

◊ provides statistical data and analytical reports;

◊ analyses of policy measures and policy tools related to the uptake of advanced technologies

◊ analyses of technological trends in competing economies

◊ access to technology centres and innovation hubs across EU countries

∇ **The Technical Assistance Facility for Modernization (TAF)** as part of the **Interregional Investment** financing support provided project owners with the opportunity to interact with business, corporate finance, and legal experts from top business consulting firms to improve their business strategies and interregional projects' readiness for investment [19].

**Additional features of the cluster:**

∇ Promoting the green transformation within the EU and beyond;

∇ Assistance to policymakers;

∇ Discussion among EU nations: European expert group on clusters;

∇ Emerging industries and value chains- Within the environment built by clusters, businesses from many industries can compete and work together.

As can be seen, the European Commission has exploited the strong ecosystem of clusters that has grown over time and positions clusters at the centre of the measures they recommend for implementation at the European level.

**This paper aims to present a perspective of South African initiatives for developing an ecosystem of clusters and cluster policies in comparison to European ecosystem of clusters and cluster policies.**

In order to reach this goal, it is required to establish some essential components for the creation of clusters, namely: **cluster architecture, the type of clustering initiative and the governance structure and cluster policies.**

**1. Cluster architecture**-this paper defines the cluster's architecture as consisting of all the actors that compose the cluster. The Triple Helix Model, which includes **authority ⇔ business ⇔ university**, is the most used framework for describing cluster components [5, 25].

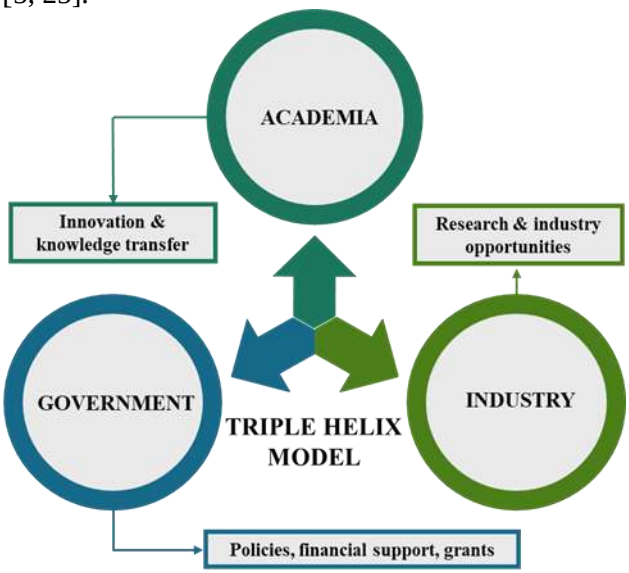


Fig. 1. The Triple Helix Model
Source**:** Figure of the authors represented in accordance with Egorova, Babkinb, Kovrova, Muravevab, (2015) characterization )[5].

Some states, such as Romania, have extended the Triple Helix model by including additional elements to fully group the relevant actors and create a functional cluster.

The triple helix model was modified by Romania by including **catalytic organizations**, giving it the name "four-leaf clover" model [20, 27].

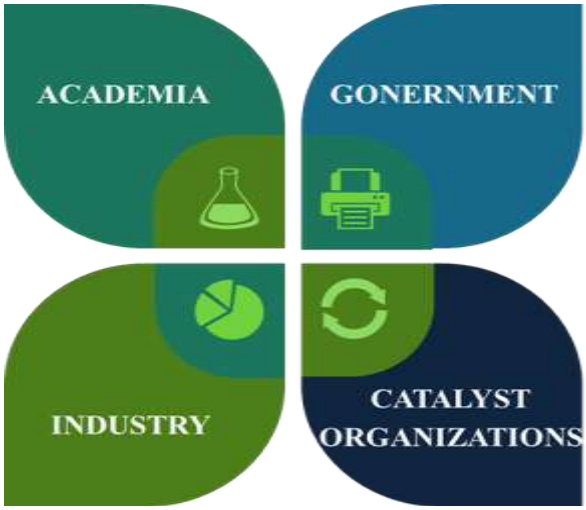


Fig. 2. "Four-leaf clover" model
Source: Figure of the authors represented in accordance with Mazilu's 2013 characterization [27].

**2. Cluster initiative** refers to how the cluster initiative was established, such as whether it came up naturally from the industry **("bottom-up approach")** or whether public authorities took the initiative to create specific clusters **("top-down approach")** [23, 28].

**3. Governance structure -** it consists of the organisational structure needed for the cluster to operate.In this respect, the following can be mentioned:

∇ The term "**cluster initiative**" refers to concerted efforts by businesses, the government, and/or the scientific community to advance the growth and competitiveness of clusters in a certain area [1, 3].

∇ **Cluster organisation-** legal structures known as cluster organizations help networks merge and form, encourage learning in innovation clusters, and help members of the community receive specialized and individualized services [8].

∇ **Cluster management-** in cluster management, there are two main parts: the operational cluster management, which consists of the cluster manager and the employees, and the strategic management structure, which consists of a cluster board and advisory committee made up of representatives of the companies/entities in the cluster [31].

∇ **Cluster strategic plan-** this is a tool for organizing and tracking organizational performance as well as one that presents

growth options consistent with the chosen goals and course of action. It refers to the framework required for boosting the cluster's long-term value [24].

**4. Cluster policies**- are regulation that consists of a selection of specific government initiatives designed to support already-existing clusters and/or encourage the creation of new ones [8].

The maturity of cluster policies has been mapped by ECCP at both the EU and worldwide levels, taking into account the legislative role in establishing and fostering the growth of clusters.

In determining maturity, ECCP examined 4 key elements [18].

∇ **Policy scope-** if the country has a specific policy for clusters or aims to build and/or develop clusters through more general strategies

∇ **Consistency of cluster policies-** rates the country's duration and experience when creating cluster policies, are evaluated only existing cluster policies not general policies.

∇ **Evidence of performance-** the existence of evaluation and assessment mechanisms to measure the level of political development in the country.

∇ **Instruments-** rates if policies offer any resources to aid in the execution of policies, either financial and/or technical help.

The clustering potential in South Africa will be further examined using the components outlined above, starting with the European perspective of clusters and cluster policies.

## MATERIALS AND METHODS

To demonstrate the potential of clustering in South Africa, qualitative research was conducted through a bibliographic review and documentary analysis (documents, records and case studies).

An investigation of the criteria used to characterize the maturity of cluster policies was also carried out [21].

Official reports and official statistics data regarding clusters in Europe and South Africa were the sources of the research materials. European Commission and European Clusters Collaboration Platform, Department of Trade Industry and Competition Republic of South Africa served as the research's primary sources [4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 32].

As can be seen secondary data were consulted by the authors to carry out the present research [26].

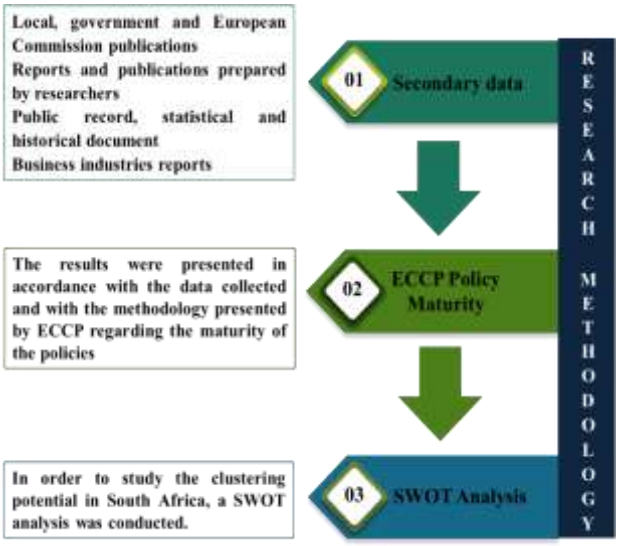


Fig. 3. Research methodology outline
Source: Authors' processing.

According to ECCP, there are only two countries in Africa that have had to do with the cluster concept or cluster policies over time, namely South Africa and Morocco. The findings were provided in line with the ECCP methodology on the maturity of the policies after consulting all the data gathered to highlight the outcomes. This was followed by an analysis based on the SWOT Analysis. The SWOT analysis, also referred to as the SWOT matrix, is used in the business field to assess a certain decision, project, or extensively to evaluate a policy direction [22, 30].

## RESULTS AND DISCUSSIONS

The ECCP report on cluster policies in South Africa served as the starting point for the presentation of the outcomes, which then moved on to the presentation of the results at the national level. The authors conducted a SWOT analysis on the basis of the findings to

assess the possibility of building a strong ecosystem of clusters in South Africa.

Based to the report prepared by ECCP, South Africa established and carried out two initiatives oriented to industrial agglomerations, namely the Competitiveness Improvement Programme and the Special Economic Zone Programme.

The Competitiveness Increasing Programme, as can be observed, takes a specialized sectoral approach.

Table 2. Overview of the CIP programme for cluster support in South Africa (2009-present)

| COMPETITIVENESS IMPROVEMENT (CIP)PROGRAMME | | |
|---|---|---|
| **OBJECTIVE** | **INSTRUMENTS** | **2009** |
| ∇ Cooperation between businesses or industry and RTDI actors should be improved<br>∇ Enhancing SMEs' capacity for growth and competitiveness the promotion of internationalization efforts<br>∇ Promoting R&D, technology development, and application<br>∇ Promoting inventiveness and enhancing innovation ecosystems<br>∇ Enhancing the cluster organizations' network and cross-clustering | ∇ **Financial:** Funding collaboration initiatives; Support to R&D projects, SMEs becoming cluster members<br>∇ **Technical assistance:** Infrastructure; Support for hard skill and soft skills development; Support for networking and partnership building; Marketing activities. | |
| **BUDGET** | **FOCUS & BENEFICIARS** | |
| Maximum overall support for common cluster projects: EUR **1.3 million**<br>Financing for national clusters and the subnational clusters that sustain them:<br>∇ grant for initial investment equal to 100% of the first year's approved expenses;<br>∇ 95% from the CIP in the second year;<br>∇ 90% in the third year<br>∇ 80% in the fourth year<br>∇ 70% in the fifth year from the CIP | **SECTORAL APPROACH** ⇒ Mainly targets: clothing, textiles, footwear, leather, and leather goods manufacturing industries<br>∇ SMEs<br>∇ Research organisations<br>∇ Large firms<br>∇ General population | |
| **RESPONSIBLE AUTHORITIES & SOURCE OF FINANCING:** The main organization in charge of creating, implementing, and funding the CIP in South Africa is the Department of Trade and Industry (DTI). | | |
| **RESULTS:** Overall, the CIP was successful, according to a 2017 assessment. Cluster members have been able to increase their direct exports of clothing or their sales to regional stores. The export of shoes to other countries and the Eurozone helped to supplement these exports. CIP also succeeded in keeping existing jobs in the sector and adding new ones. Moreover, Big Retailers work more closely, either individually or in groups, with regional producers. | | **present** |

Source: Authors' processing according to data from the ECCP report [17].

According to the findings that have been made public, the program was able to help accomplish the objectives that were intended. A report on the CIP outcomes states that 61 applications were submitted in 2017, of which 22 company-level projects and 39 cluster initiatives [17]. The program is able to fund applications for up to five years, and even if

the grant rate declines, the financial help is still significant until year five (70% grant).

Table 3. Overview of the SEZ programme for cluster support in South Africa (2012-present)

| SPECIAL ECONOMIC ZONE (SEZ) PROGRAMME | | |
|---|---|---|
| **OBJECTIVE** | **INSTRUMENTS** | 2012 |
| ∇ Boosting competition and encouraging the growth of SMEs<br>∇ Facilitating internationalization efforts<br>∇ Promoting of technological development, technology implementation, and research and development<br>∇ Building innovative ecosystems and encouraging innovation<br>∇ Encouraging business startups and spinoffs<br>∇ Promoting the social economy, the sustainable economy, and other initiatives based on solidarity<br>∇ Encouraging employment and enhancing abilities<br>∇ Linkage to world supply chains | ∇ **Financial:** Subsidies to hire personnel; Subsidies for cluster infrastructure (e.g. offices, equipment); Other: encouraging foreign investment; tax stimulants; discounts; customs controlled areas; donation of land or provision of land at a reduced rate by municipalities for the establishment of SEZs; provision of utilities; sometimes at preferential rates.<br>∇ **Technical assistance:** Infrastructure; Support for hard skill and soft skills development; Marketing activities; Others: Specialised waste services | |
| **BUDGET** | **FOCUS & BENEFICIARS** | |
| Dates about the budgets are not available | **SECTORAL APPROACH** ⇒ Mainly targets: industries and manufacturing focused on exports, including those in the automotive, agro-processing, chemical, general, business process outsourcing, and energy industries.<br>∇ SMEs<br>∇ Start-ups<br>∇ Large firms<br>∇ General population<br>∇ Others: Foreign investors | present |
| **RESPONSIBLE AUTHORITIES & SOURCE OF FINANCING:** The main organization in charge of creating, implementing, and funding the SEZ in South Africa is the Department of Trade and Industry (DTI).<br>The SEZ Programme is also financed by Department of Economic Development Environmental Affairs and Tourism, and regional organizations such the Buffalo City Metropolitan Municipality for the East London IDZ. | | |
| **RESULTS:** According to ECCP, the last information was recorded at the level of the years 2012–2013 in terms of data about the evaluation of the impact that the SEZ Programme had. | | |

Source: Authors' processing according to data from the ECCP report [17].

To complete the information above, the Special Economic Zone (SEZ) program aims to facilitate the growth process of industrial agglomerations that attract investment and encourage the development of business capacity through the creation of clusters. The

SEZ program, like the CIP program, adopts a sectoral approach; the beneficiaries being almost the same category, but they support a number of industries, especially those with export potential.

South Africa received a score of **6p** for its performance in the analysis conducted by ECCP regarding the maturity of cluster policies. This score is obtained as follows: Policy Scope 2p, Continuity 1p, and Clusters Cluster Support Instruments 2p. A maximum of 2 points can be earned by each of the three criteria. South Africa received a score of 1 (out of a possible 1 point) for the Evidence of Performance criteria.

The ECCP report's data analysis revealed that there are measures that address the economic environment and that have persisted despite brief interruptions.

In addition to the European perspective provided in the ECCP study, the authors also reviewed the specific websites of the bodies in charge of putting cluster support policies into action and were able to note the following:

∇ A program called the Cluster Development Program (CDP) which was funded by the DTI existed, which aimed to promote industrialisation, long-term economic growth and the need for job creation in South Africa [4].

∇ No information is available regarding the status of CDP funded initiatives.

In the following, a brief presentation of the CDP will be made, based on the data contained in the document Pilot Guidelines for the Cluster Development Program (CDP).

The CDP's goal was to make businesses within a cluster more competitive. Additionally, it suggested putting the plan into action through clearly defined collaborative initiatives that deal with marketing, productivity, and production.

The following industries were chosen as priority and qualified for application:

∇ Metal fabrications, capital equipment and rail transport;

∇ Plastics, chemicals, cosmetics and pharmaceuticals;

∇ Forestry, timber, pulp, paper and furniture;

∇ Agro-processing;

∇ Business process services;

∇ Cultural and creative industries, crafts, music and film;

∇ Boat building;

∇ Green and energy saving industries;

∇ Development of minerals downstream;

∇ Upstream oil and gas services and equipment;

∇ Nuclear;

∇ Advanced manufacturing (including defence, aerospace, electrotechnical and white good.

Table 4. Supported activities of the Cluster Development Programme and the requirements for applications

| **SHARED INFRASTRUCTURE GRANT** | |
|---|---|
| ***Financing conditions*** | ***Focus areas*** |
| ∇ Non-taxable matching cash grant of up to 80% of the investment<br>∇ Maximum of R10 million per cluster<br>∇ Shared infrastructure | ∇ Enterprise Development<br>∇ Location<br>∇ Skills development<br>∇ Export promotion |
| ***Eligible expenses*** | ***Excluded expenses*** |
| ∇ Building<br>∇ Machinery and equipment<br>∇ Commercial vehicles<br>∇ Tools, jigs and dies | ∇ Office furniture<br>∇ Computer furniture<br>∇ Land costs |

| BUSINESS DEVELOPMENT SERVICES | |
|---|---|
| ***Financing conditions*** | ***Focus areas*** |
| ∇ Non-taxable cash matching grant of up to 80% of the investment<br>∇ Maximum grant of R5 million per cluster | ∇ Innovation<br>∇ Employment creation<br>∇ Product development<br>∇ Supplier Development Programme (SDP) |
| ***Eligible expenses*** | ***Excluded expenses*** |
| ∇ Cost of consulting<br>∇ Costs of benchmarking<br>∇ Conformity reviews, and accreditation, as well as local and international intellectual property registration<br>∇ Feasibility analysis fees<br>∇ Product/technology advancements<br>∇ Post-prototype development (validation and testing of the prototype)<br>∇ Bio-prospecting | ∇ Engines and other assets<br>∇ Land and structures<br>∇ Automobiles<br>∇ Travel and expenses for accommodation |
| **CLUSTER MANAGEMENT ORGANISATION (CMO) FUNDING** | |
| ***Financing conditions*** | ***Focus areas*** |
| ∇ Grant of non-taxable matching funds equal to up to 80% of the expenditures associated with establishing the CMO<br>∇ R5 million maximum per cluster | ∇ Relevant industry knowledge and experience<br>∇ Compliance with governmental directives<br>∇ Public/Private Partnership<br>∇ Proven capacity to expand and foster the launch of new companies or SMEs in the industry<br>∇ Demonstrated capacity to organize workshops that foster networking and information sharing for the cluster |
| ***Eligible expenses*** | ***Excluded expenses*** |
| ∇ Project management fees<br>∇ Administration fees<br>∇ Wages and salaries (limited to a total of three employees and capped at R2 million or 70% of the total payroll, whichever is smaller)<br>∇ Rent limited to R250 000 and may not exceed 70% of the rental cost<br>∇ Office furnishings and supplies<br>∇ Operating expenses, including those for electricity, water, telephones, and stationery<br>∇ Travel and accommodation expenses, including travel expenses and allowances (limited at R50,000 annually)<br>∇ Charges for event management (for networking events) | ∇ Capital equipment<br>∇ Land and buildings<br>∇ Vehicles |

Source: Authors' processing in accordance with information from the paper Pilot Guidelines for the Cluster Development Program (CDP) [2].

Clusters in the automotive, clothing, leather and footwear sectors that are already receiving were not eligible for funding benefits from the DTI industrial policy sector office. The program focused on funding for cluster management organizations, business development services, and supporting investments in shared infrastructure. The DTI, the organization in charge of carrying it out, suspended the Cluster Development Program since April 1, 2018 [4]. There are no public statistics on the impact it had on the applicants. It can be seen that CDP was a program that complemented SEZ and CIP in that it targeted the other industries. Both CIP and SEZ have so far succeeded in maintaining continuity with and supporting their intended beneficiaries over a long period of time.

In order to determine South Africa's potential for creating a cluster environment and the enabling policies for this ecosystem, the authors used the information indicated above to conduct a SWOT analysis.

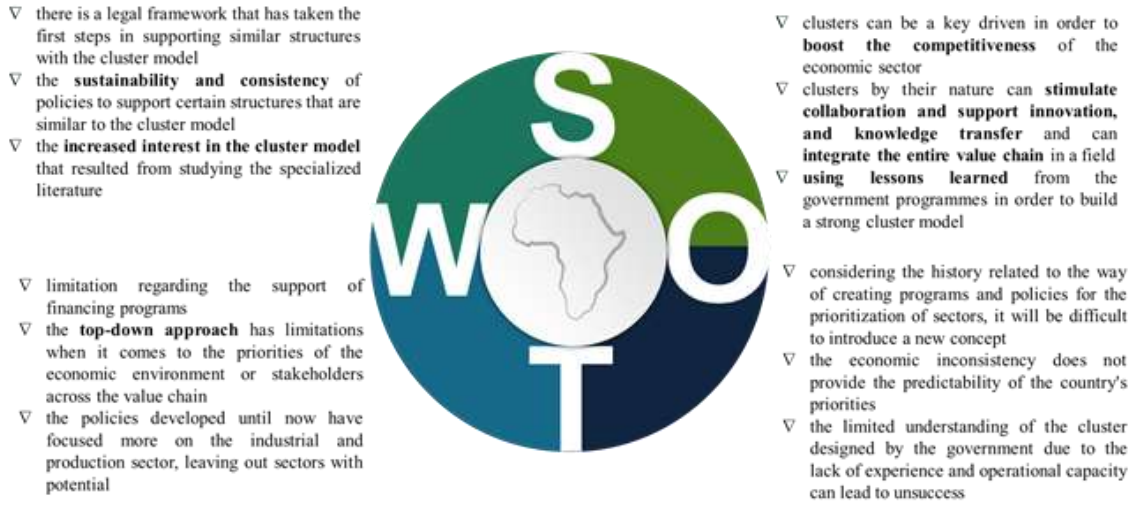


Fig. 4. SWOT assessment of the clustering potential in South Africa
Source: Authors' processing.

With experience in administering complex programs to facilitate cooperation in several industries, South Africa has good prospects for the creation of high-performance cluster ecosystems. There are cluster efforts that were supported, according to both the data from the ECCP report and the official sources of the authorities in charge of developing and implementing the programs specific to the different clusters, but there is no hard evidence of the lessons learned. However, it is unclear why the DTI decided to stop funding the CDP initiative. This cluster support program was the one that was most similar to the ones in Europe.

## CONCLUSIONS

Cluster ecosystem creation and preservation require a variety of strategies, and South Africa has been effective in adjusting its programs to the local economic circumstances.

**Regarding the clustering potential, South Africa offers promising prospects, and the European models can unquestionably serve as examples of good practices for developing a useful cluster model.**

A perspective more closely aligned with the economic realities of the business, academic, and research environments that represent the major actors involved in the operation of a cluster could be obtained by broadening the way of approaching how clusters are formed through the transition from **top-down to bottom-up approach.**

In order to design cluster policies that are as tailored to the development requirements of

the cluster ecosystem as possible, the authorities in charge of establishing them could draw on the knowledge gained from earlier initiatives.

Beyond clusters, there are undoubtedly other layouts and strategies for interventions that impact businesses. Cluster initiatives may not be the best way to encourage regional economic development for many regions or even for many countries. Each government should design its own strategy to encourage the growth of collaboration and boost business competitiveness.

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# SHEEP AND GOAT BREEDING IN ROMANIA - BETWEEN TRADITION AND CONSUMPTION

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***Abstract***

*The paper highlights the activity of raising sheep and goats in Romania, and the consumption of meat from these categories of animals, in the period 2015-2021, while also sketching the autochthonous ethnographic framework where the economic activity is placed - the tradition records millennial pastoral aspects that are still preserved more or less formally with deep echo in Romanian popular spirituality, reflected in popular beliefs, traditions, customs, folklore. The paper analysed specific indicators of the sheep and goat breeding sector, such as: quantitative fluctuations of the number of sheep and goats; the sheep meat production obtained in slaughter houses; the number of sheep slaughtered in slaughterhouses; the price for sheep meat "per 100 kg live weight" and the average annual consumption, per inhabitant, of sheep and goat meat. The statistical sources for our data are the National Institute of Statistic and Eurostat, as well as other specialized materials. Statistical data showed that in Romania in 2021 there were over 10,000,000 sheep and approximately 1,500,000 goats.*

***Key words*****:** *sheep, goat, herds, meat, price, consumption, Romania*

## INTRODUCTION

Raising animals on the pastures and hayfields generously offered by the Carpathian-Danubian-Pontic area is an ancient, traditional occupation of the (pre)Romanians, which created a cultural complex tailored temporally and locally according to the specific features of the historical eras successively reunited in about 10 millennia of European civilization initially dominated by the Neolithic Mother Goddess (8000 -2500 B.C.), later by the Indo-European Father God (2500 B.C. - 0), then massively imprinted by Christianity. Ghinoiu records that the shepherds possessed remarkable knowledge (in meteorology, astronomy, folk medicine) as a sine qua non condition for survival in social groups of 15-20 individuals separated for a long time from the community of belonging and permanently subject to risks (extremes weather conditions, wild animals, initiation of routes, etc.)[8].

The millennial transhumant shepherding, with its Romanian peak in the mid-19th century and on the way to extinction in the first half of the 20th century [8], drove huge flocks of sheep in search of pastures on European geographical coordinates much larger compared to the territories inhabited by the Thracians; for the pastoral summer, the flocks were led to mountainous regions (in the Carpathians, the Dinaric Alps, the Rhodope Mountains, the Pindus, the Caucasus), while the wintering took place in plain or steppe areas (the coastal plains of the Black, Caspian, Adriatic, Ionian and Aegean Seas, in the Ponto-Caspian steppes, up to the Crimea and the northern Caucasus). It is considered that in the Middle Ages European transhumance was practiced on a large scale, from the Balkans, through Italy and France, to Spain and Portugal [8], that is why the magnitude of transhumance led us to compare it with the Silk Road as far as its impact on creating links (the initiation of communication roads and, later, the transformation of some of them into major communication routes), on intra- and transcultural civilizational exchanges, the

rural development being one of its consequences.

The Romanian rural space of our days still preserves, through household practices, in the mentality of the elderly villagers, in the economic activity of the younger generations able to run a business exploiting the local material and spiritual resources (through a farm, or through an agro-tourism guesthouse, or through trade with local products, agro-touristic routes like the Wine route, etc.) traces of what was once a pastoral civilization. And the vocabulary of the current Romanian language preserves many expressions originating in the countryside, proof for a keen spirit of observation and a sharp tongue that the Romanian did not lack. To exemplify this aspect, some common expressions in the Romanian vocabulary up to nowadays are: the goat jumps the table and the billy goat jumps the house (in Romanian: *capra sare masa, iada sare casa*) with the meaning that the offspring surpass their parents, especially in negative aspects; to reconcile both the goat and the cabbage (in Romanian:*a împăca și capra, și varza*) with the meaning of reconciling divergent interests; he (the wolf) took off his sheep's clothing (in Romanian: *s-a dezbrăcat (lupul) de pielea oii*) marks the moment when a person pretending to be gentle and harmless shows his aggressive, dangerous side; to take (or remove) two skins from one sheep (in Romanian: *a umbla să iei (sau să scoți) două piei de pe o oaie*) means to exploit a resource mercilessly, abusively.

Over time, pastoralism represented a significant aspect of agriculture in our country, because it contributed, on the one hand, to ensuring food security, and on the other hand, to the continuation of life on the mioritic plains [5, 26].

Regarding the sheep raised nationally until the second half of the 19th century, it was noted that they were belated, rustic breeds and types. However, they were distinguished by an increased degree of adaptability to the temperate continental climate. We must also remember the fact that these rustic breeds were very resistant to diseases. Among these, the most well-known are: the Țurcană breed, a variety of Stogoșa populations, but also a smaller herd of Țigaie [4].

We can affirm that the activity of raising sheep and goats in our country was and will remain a specific and traditional activity for certain regions because the diversity of the productions obtained, the low energy consumption, together with the specificity of the fodder that these animals prefer, confer a sustainable nature of this occupation [21].

During the analyzed period, the sheep and goat herds evolved differently from one year to the next, with the highest number of sheep recorded in 2019 (10,358,699) and goats in 2020 (1,611,785).

In 2019, the provided data ranked Romania in the 3rd position regarding sheep and goat breeders across the European Union, while the density of animals per hectare was three times more reduced [19].

In 2021, according to the official Eurostat data, Romania ranked the 2nd position in the top of the sheep breeders (it had 17% of the existing flock at the level of the European Union), after Spain, which had a flock of 15,081,350 heads (held 25% of the existing herd at the level of the European Union), and in 3rd place in terms of goats herds, after Greece (3,135,100) and Spain (2,589,760) [2].

Taking into account the local premises, the purpose of the paper is to investigate some aspects related to traditions in the field of raising sheep and goats and on the national consumption of meat. In order to capture both aspects specified previously, the paper analyzed relevant economic indicators for the sheep and goats raising and commercialization sectors, simultaneously with highlights from the millenary reservoir oftraditions, customs, popular beliefs with a still active and partially explanatory role within the contemporaryRomanian countryside.

## MATERIALS AND METHODS

In order to create the autochthonous ethnographic framework where the economic activity is placed, we used as methods the reading (with multiple directions of investigation and various sources of

information, keeping a reference work as the main resource) and its processing by structuring and analysis according to certain coordinates relative to the pastoral specificity: the calendar of the pastoral year, the traditional pastoral activities with their related atmosphere, rituals and symbolism, aspects related to the domestic industry through which the sheep products are valued and other aspects reflected in the Romanian popular mentality as a result of these ancestral occupations in which the human being lived in close connection with nature and developed successful direct activities (not mediated by technology) for living within community.

In order to analyse the sheep and goat breeding sector, the following indicators were analysed for the period 2015-2021: sheep and goat herds at national level and by development regions; the number of heads and the production of slaughtered sheep meat, the price (for 100 kg of live meat) and the average annual consumption per capita. The data were retrieved from National Institute of Statistics and Eurostat, and in order to highlight the results as best as possible, they were interpreted and presented in graphic form.

## RESULTS AND DISCUSSIONS

In Romania, the pastoral year brings together two symmetrical seasons (summer and winter), which are mutually delimited temporally by Christian feast dates (after the Christianization of the Romanians), four calendar dates being the benchmarks for planning the entire activity of animal breeders, especially for sheepmen: the beginning of the pastoral summer on April 23 (St. George, the same as Sângeorz), the midsummer on July 20 (St. Elijah), the end of the summer when the pastoral winter opens, on October 26 (St. Dumitru), with the pastoral midwinter on the night of 15-16 January (St. Peter of the Wolves).

In the pastoral summer, the sheep were taken to the mountains, their milk and wool were collected and used, and they were fed to optimally enter the breeding and wintering season.

The typical activities of the annual pastoral cycle are the following:

• *Sâmbra oilor* (or, depending on the area, *Arieţul, Ruptul Sterpelor, Măsurişul oilor*), on Sângeorz or on another day at the end of April, represents the first milking of the flock of sheep (as an indicator of their productivity, which will correlate in late summer or early autumn, when the flock is disintegrated, with the amount of products distributed by the shepherd to each sheep owner, accompanied by rituals to protect the fold and the shepherds from evil forces, followed by a country party with a rich meal („*balmos*, […] the roast lamb, ring biscuits, cottage cheese from the first milking" [8]), songs and games with pastoral theme;

• *sheep and rams are/were sheared in the village* in the same period (between Sângeorz and Arminden);

• *the flock goes up to the mountain* where, for economic reasons, the shepherds keep the sheep separately from the rams;

• *shearing of the lambs* (July 20, St. Elijah) - for this purpose their owners go up to the flock. The same day is also an occasion for a long-awaited reunion between the shepherds and their wives/fiancées.

• *the descent of the sheep* (between August 1-15, Sf. Mary): the shepherds brought the flock to the village, each peasant recovered his sheep, received the related dairy products, paid the shepherds and then, despite the altercations that still arose at the "closing of accounts ", at the end they partied together with the whole community.

Today we have ethno-culinary festivals such as *Răvăşituloilor* from Bran, Braşov, where producers and other merchants exhibit and sell traditional products (sheep pastrami, cheese specialities, etc.), and consumers taste and party with music and cheerfulness.

• *The wedding of the sheep* (in Romanian:*Nuntaoilor* or similar names as *Năpustitulberbecilor (arieţilor)* or *Mârlituloilor*, between October 14, St. Parascheva – November 8, St. Mihail and Gavriil) refers to the pairing of sheep and goats. After the pairing at the beginning of the pastoral winter it follows the gestation (cca.21

weeks long), so the lambs and kids are born in March and weaned late in April.

Romania is a country where the raising of sheep and goats works well as it has the proper geographical position and all the landforms: mountains, hills, plains; these include a big amount of pastures that permit the phenomenon of transhumance [24].

An important peculiarity of raising sheep is the fact that their exploitation is not closely related to the existence of the land related to the production of bulk fodder. Sheep food can be provided through transhumance. This is a fairly old method practiced by shepherds. Currently, in our country, transhumance can be recommended, as an efficient method of raising sheep[7].

In time, the quantity of domestic sheep and goats in Romania varied, determined by internal and external factors. We note the increase of the number of sheep in 2021 by 2.83% compared to year 2015 and, for the same period of time, also the number of goats increased by 3,64%.

- Figure 1.

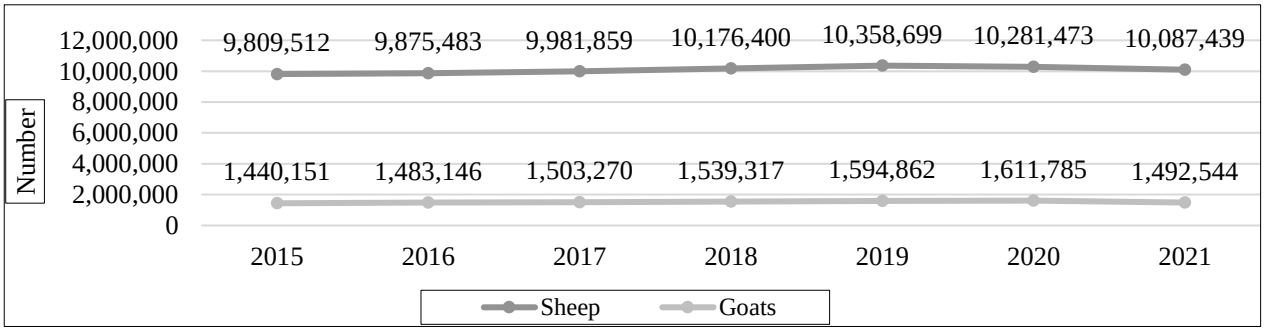


Fig. 1. Dynamics of sheep and goat herds in Romania, in the period 2015-2021
Source: our design after [10].

In 2021, the Centre Region had the largest herd of sheep, 2,260,165 (representing 22.41% of the total), and was followed by the North-West Region - 1,821,136 and the South-East Region with 1,565,386 heads - Figure 2. Apart from the Bucharest-Ilfov Region, in the South Region -West Oltenia grew the fewest specimens (626,121). In the period 2015-2021, sheep flocks evolved differently at country level. Thus, we recorded increases in the Regions North-West - 10.43%, West - 4.40%, South-Muntenia - 3.94%, South-East - 3.77% and in the Centre Region - 2.00%. The other Regions recorded decreases, as follows: Bucharest - Ilfov - 60.60%, South-West Oltenia - 7.82% and North-East - 1.74%.

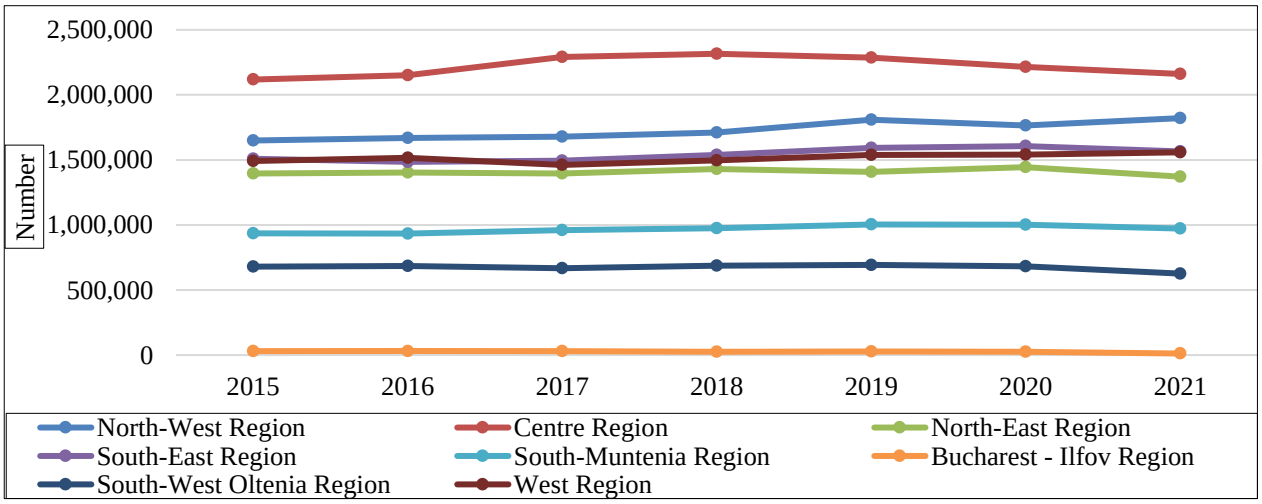


Fig. 2. Dynamics of sheep flocks in the development Regions of Romania, in the period 2015-2021
Source: our design after [10].

In 2021, the South-East Region had the largest herd of goats (379,491 - representing 25.43% of the total), followed by the South-West Oltenia Region - 287,872 and the South-Muntenia Region with 267,234 heads - Figure 3. The Bucharest-Ilfov Region had a number of 4,305 heads. In the period 2015-2021, both increases and decreases of goat herds were recorded in the Development Regions. Thus, the increases were found in the West - 10.33%, North-East - 6.58%, South-WestOltenia - 6.50%, North-West - 4.54%, South-Muntenia - 4.03% and South-East - 3.18% Regions. In the other Regions, the number of goats decreased, as follows: Centre Region - 4.21% and Bucharest - Ilfov - 60.60%.

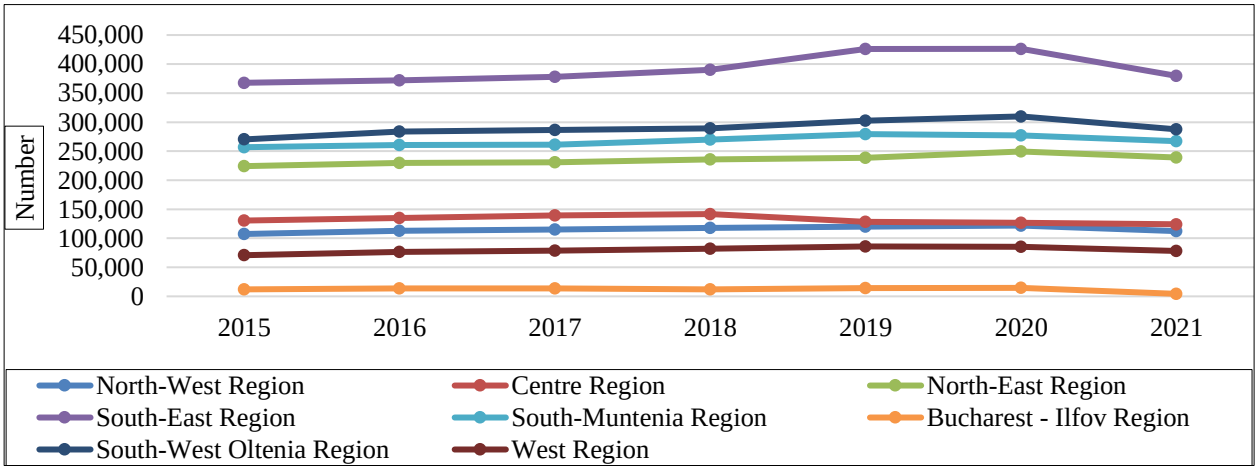


Fig. 3. The dynamics of goat herds in the development Regions of Romania, in the period 2015-2021
Source: our design after [10].

As can be seen from Figure 4, the number of sheep slaughtered in slaughterhouses in our country decreased by 46.61% in 2021 compared to 2015. The drastic decrease occurred after 2019, with the emergence of the Covid 19 Pandemic. In 2018 Romania slaughtered the most sheep, 814.82 thousand heads.

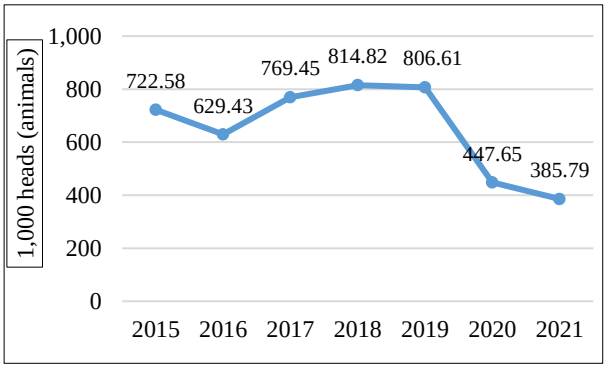


Fig. 4. The number of sheep slaughtered in slaughterhouses in Romania, in the period 2015-2021
Source: our design after [6].

The direct consequence of this decrease in number of the sheep is the decrease of the production of meat from these animals, also noted in Figure 5. The decrease was of 29.86% in 2021 compared to 2015. The largest amount of sheep meat was obtained in 2018 – 11.97 thousand tons, corresponding to the large number of slaughtered heads.

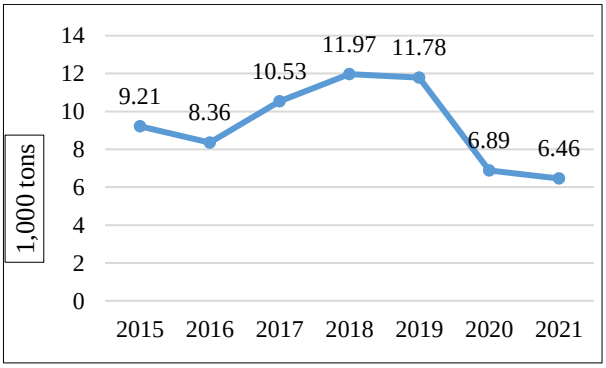


Fig. 5 Sheep meat production obtained in slaughterhouses in Romania, in the period 2015-2021
Source: our design after [6].

Regarding the price for sheep meat "per 100 kg live weight" with small fluctuations, here we can record an increase - 157.76% in 2021 compared to 2015. The year 2018, with the highest production of slaughtered meat, recorded the lowest sheep meat price - 390.00

lei/"100 kg live weight", the highest being in 2021 - 620.00 lei/"100 kg live weight" (Figure 6).

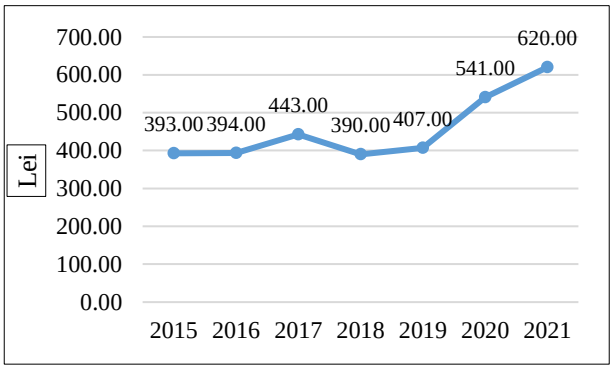


Fig. 6 Price for sheep meat "per 100 kg live weight", in Romania, in the period 2015-2021
Source: our design after [6].

Rituals: In the traditional rural environment, practical activities were accompanied by pre-Christian ritual acts with protective role for the community's members and their properties from evil forces. Ghinoiu[8]mentions a series of such practices through:

1. recourse to fire (lighting the Living Fire, smoking shepherds and sheep),
2. recourse to water (symbolic purification of sheep and/or their owners by sprinkling with holy water, bathing in clean, clear river water, washing with dew),
3. recourse to sound and logos (cries to ward off evil forces, magic formulas),
4. recourse to offering and/or sacrifice (ritual food, lamb sacrifice).

A reminiscence of the prehistoric zoomorphic goddess and the Saturnalia practiced by the Romans is the ritual called *Turca* (synonymous, depending on the ethnographic area, with *Capra* (The Goat), *Boura*, *Brezaia*), still celebrated in the New Year traditions.

*Turca* symbolically comes to life at the moment when it is objectified in the form of the animal mask (usually a goat mask) and lives only on the day between years, through the character who animates her - a boy who wears the mask (and the associated goat costume) and his fellows - on the streets of the village, in a group of noisy boys, who, through rhythmic folk songs, draw the community's attention on the coming of the New Year (as a renewed time!), because the old year (the "trouble maker" *Turca*) is dying to make way for the new year, respectively for new opportunities during a renewed time [8]. Currently, the custom is also being adopted in the city.

*Lamb sacrifice* also has millennial origins, both among Indo-Aryan peoples such as the Geto-Dacians (sacrificing lambs in the spring to mark the rebirth of nature through a feast with the meat of the domestic animal at hand that was born in the spring) and among the Jews and Muslims, in honour of the divinity.

The lamb also becomes one of the Christian religious symbols, because the prophets of the Old Testament had announced under this name God incarnated in man, and John the Baptist had said showing Jesus Christ to the Jewish people "Behold the Lamb of God", the one who died for the salvation of the world. And if the Jews Easter means celebrating, with lamb sacrifice, the transition from Egyptian slavery to freedom, for Christians Easter is the greatest celebration and means the transition from death to eternal life through the sacrifice and the redemptive resurrection of Christ.

Since ancient times, people have resorted to sacrifice and offering as solemn and supreme forms of addressing the divinity in order to obtain a blessing. In this sense, according to Văduva apud Parlog [23] notes that in some areas of Romania, the lamb is sacrificed after its ritual purification and the purification of the one who sacrificed the animal.

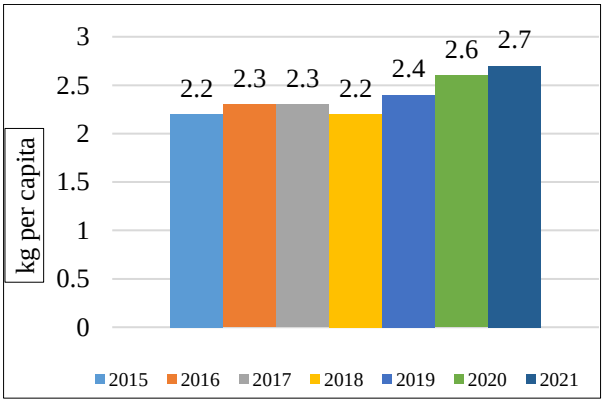


Fig. 7 Average annual consumption, per inhabitant, of sheep and goat meat (in fresh meat equivalent) - kg per capita
Source: our design after [11-17].

Faced with the innocence of the lamb, we can naturally ask: why the sacrifice? Because "the sacrifice of a living being is necessary for the perfection of any creation, as valuable actions with valuable and unfading outputs can be raised and secured only through a sacrifice", according toEliade apud Parlog [23].

The average annual consumption per inhabitant of sheep and goat meat registered variations during the analysed period. - Figure 7. From the statistical data presented, it can be easily observed that the lowest consumption was recorded in 2015 and 2018 (2.2 kg per capita). In the 2016-2017 period, it was of 2.3 kg per capita. In Romania, sheep and goat meat represented 3.5% of total meat consumption in 2016 and is a "must have" for national consumers, especially during the Easter period of the year [9]. Starting from 2019, we observe an upward trend in the consumption of mutton and goat meat, reaching a maximum in 2021 (2.7 kg per capita). The consumption of lamb meat at the level of the European Union, but also at national level, depends on a variety of market factors, and on certain social factors that are quite difficult to measure[25].

It is known that, in Romania, the consumption of sheep meat is seasonal, but the program "*Alegeoaia/ Choose the sheep*" has led to increase this consumption for Romanians[20].

Along with meat, the raw materials obtained from the breeding of sheep and goats (milk, derived from milk) favoured the development of the household food "industry", as well as of those of processing wool, hides, and furs.

Photo 1. Equipment from the complex of traditional wool processing facilities "La vâltori", dating from the mid-19th century (Brașov, Lisa)
Source: [18].

Transmitted from generation to generation, traditional milk processing technologies and related culinary tools (such as cheese mold) have been preserved and are still being used, as well as the various technical installations for processing wool and wool products (see the complex "La vâltori" from Lisa/Brașov [18], dating from the mid-19th century– Photo 1).

The wool spinning, women's and girls' activity (Photo 2), was mainly held in organized sessions from mid-autumn to early March, in an atmosphere of song and jovial mood. The deadline for completing the spinning of wool (and hemp) was Maundy Thursday in Easter Lent.

Photo 2. Romanian spinning social soiree (șezătoare) after finishing agricultural work
Source: [1].

Photo 3. Costume for the goat dance (*Turca* dance)
Source: [3].

And the woollen fabrics, through their craftsmanship, ingenuity, the art of making them (in the collection of the Museum of the Romanian Peasant in Bucharest, all the weaving and ornamentation techniques of the carpets are documented[22]), have gone beyond the initial utilitarian goal, becoming a major element of great value in the architecture and aesthetics of the interior, both in noble and peasant houses, being recorded in the dowry sheets of the time and left as a family legacy (Photo 3).

According to MADR [21], nowadays, several representative objectives are pursued in the sheep breeding and marketing sector:

- boosting the association, especially in order to increase the young sheep for fattening;
- ensuring the internal market with mutton;
- increasing the average annual consumption of mutton per inhabitant;
- increase in sheep meat exports;
- obtaining higher incomes for the sheep breeders, through the commercialization of the goods production.

Currently, at the national level, the aim is to stimulate the sheep and goat raising sector, which ensures both constant income for producers and products for consumption together with maintaining and capitalizing the most representative traditions, thus so that future generations have access to some aspects related to the history and identity of the Romanian people.

On the identity side, last but not least, we end the results and discussions section by mentioning the Romanian folkloric jewel that is the *Mioriţa* ballad (*mioriţa* is an affectionate diminutive for the word sheep). This text bears the mark of pastoral living in communion with nature and in the human community which, bringing together individuals with antagonistic traits (the hero has a strong and generous character, strongly contrasting with that of the other two protagonists who fall prey to envy and greed), sometimes fails to become human communion. The main character, a young skilled handsome shepherd, understands the temporal character of his worldly identity and his earthly stop and based on this awareness he finds the power to peacefully receive the Unknown. As the Unknown (particularly death) is not an option but always a part of a state of art, of a human being, of existence.

## CONCLUSIONS

Starting with the tradition(s) in our lands regarding the raising of sheep and goats, the work presented millennial pastoral aspects that are still preserved more or less formally (the pastoral new year calendar, pastoral customs, the characteristics of transhumance roads) echoing in the Romanian popular spirituality reflected in practices, customs, rituals (the Easter lamb sacrifice, the Goat dance etc.) and folklore, the *Mioriţa* ballad being more than an epic thread and attitude in the face of death, its lyricism and drama (simple but deep, like a traditional peasant's mentality) rounding and beautifying, in an original, incredibly melodious and allegorical way, a Romanian human type that can even be a universal one.

In the period 2015-2021, the flocks of sheep and goats increased by 2.83%, respectively 3.64%. In 2021, the Romanian Central Region had the largest number of sheep, respectively 2,260,165 heads, while goats predominated in the Southeast Region with 379,491 heads.

The meat consumption, according Eurostat, showed for the analysed period that the number of sheep slaughtered in slaughterhouses decreased by 46.61%, and meat production by 29.86%.

Instead, the price for 100 kg of live weight increased from 393 lei in 2015 to 620 lei in 2021. Although Romanians are not big fans of sheep meat, an increase in average annual consumption was noted from 2.2 kg per capita in 2015 to 2.7 kg per capita in 2021.

We can conclude that the efforts to support the sheep and goat sector made by the competent institutions were not in vain.

## AKNOWLEDGEMENTS

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# IMPACT OF CULTIVAR CHARACTERISTICS ON THE ECONOMIC EFFICIENCY OF BIRD'S-FOOT-TREFOIL FODDER

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***Abstract***

*The selection of suitable grass fodder crops and their cultivars are key factors determining efficiency in agrarian production. In order to produce the most economically efficient bird's-foot-trefoil cultivar for cultivation under mountain conditions, research was conducted in the experimental field of the Research Institute of Mountain Stockbreeding and Agriculture-Troyan. The experiment was based on the block method with the following bird's-foot-trefoil cultivars: Targovishte 1 (Bulgaria), Bursztym (Poland), Kalo (USA), Lot (Poland), Madison (France), MO – 20 (USA), Nico (Romania) were studied for their impact on economic efficiency. It has been established that the genotypic characteristics of the cultivars and the applied production technology determine the productivity and profitability of the obtained fodder production. Soil and climate conditions has a major impact on the level of average yield, gross revenue and profitability of the obtained fodder. From an economic point of view, the Madison and Bursztym cultivars are the most suitable for inclusion in the structure cultivars in the production of bird's-foot-trefoil fodder. They realize fodder production at the lowest production costs, high gross profit and lowest production costs. Their highest efficiency ratio makes them extremely cost-effective and an alternative for agricultural practice.*

***Key words*****:** *bird's-foot-trefoil, cultivars, economic efficiency*

## INTRODUCTION

Bird's-foot-trefoil is a perennial legume that adapts well to cultivation in poorly drained soils with an acidic reaction (Churkova, 2012; Bozhanska, 2020) [2, 3]. It is self-sowing, resistant to disease and pests, responds well to fertilization and does not cause animal bloat in animals (Owens et al., 2012)[12]. As a result, it is grown in places where production of other fodder legumes is limited. In the past, bird's-foot-trefoil was commonly used in grazing systems, and nowadays there are available cultivars suitable for hay production. Legume fodder crops provide ecological benefits to agricultural landscapes in Europe, increase resource efficiency and contribute to balancing the European deficit in plant protein production (Ewert et al., 2005; Goulding et al., 2008; Jensen et al., 2010) [7, 8, 11]. Recently, there has been a decline in the production of legumes in the member states of the European Union (based on FAO). Market demand determines the specialization of cropping systems. The agricultural policy for the cultivation of fodder grasses must be consistent with the agronomic benefits and economic efficiency in the production of legume crops. To a large extent, the economic value of legumes is determined by their cultivation technology (Petkova et al., 2022)[13]. The inclusion of bioproducts with soil and foliar application in modern ecological technologies for growing bird's-foot-trefoil positively affect the productivity and quality of the fodder mass (Bozhanska, 2020a)[1]. The significance of legume fodder crops (Westhoff et al., 2009)[17] in cropping systems depends on their ability to fix nitrogen from the air (Schilizzi and Pannell, 2001)[14], their role as suitable precursors for a number of crops and their environmental impacts (Van Grinsven et al., 2014)[15]. The bird's-foot-trefoil as a nitrogen-fixing component is also significant in organic agriculture (Hirel, 2011; Vasileva et al., 2017)[9, 16], which determines the economic benefits of its cultivation. The appropriate

technological decisions of the respective legume crops contribute to extracting benefits for the environment and increasing the sustainability of agricultural production.

One such technological solution is the introduction of new high yield bird's-foot-trefoil cultivars, combining high productivity and fodder quality (Hunt et al., 2016)[10]. Correctly selected cultivars for specific soil and climatic conditions (Dragomir et al., 2011)[6], with good adaptability, lead to a reduction in the amount of production costs and the cost price of fodder production and increase its profitability (Churkova and Churkova, 2022)[5]. Appropriately defined units of technology for the production of bird's-foot-trefoil fodder is essential for increasing economic efficiency.

The purpose of the present research experiment is to determine bird's-foot-trefoil cultivars on the basis of an economic analysis, as an alternative for including the most suitable ones in the structure of agricultural production.

## MATERIALS AND METHODS

The analysis is based on data from a research experiment carried out in the experimental field of RIMSA-Troyan on a light gray pseudopodzolic soil, with an acidic reaction, low phosphorus content, good supply of potassium and low humus content. The economic analysis is made of the bird's-foot-trefoil yields obtained over the years and on average for the period 2013-2015. Database is provided by reports on the G 100 project to the Agricultural Academy and a published paper (Churkova, 2019)[4]. The experimental years differ significantly in terms of the amount of precipitation. 2015 is characterized as the driest, when the precipitation amount during the vegetation was 549.5 mm. In 2014, it was 222.6 mm more than those in 2015.

The spring was relatively cool and well provided with rainfall in the year of sowing, which favors the normal development of crops. The air temperature was above 5°C, which was suitable for the germination and development of meadow grasses. The average air temperature for the vegetation within the three years 2013, 2014 and 2015 varied within small limits (16.0, 15.3 and 16.5 °C).

The experiment was set up according to the block method in four replications with a harvest plot size of 5 $m^2$ and included the following cultivars and populations of bird's-foot-trefoil: Bursztym (Poland), Kalo (USA), Lot (Poland), Madison (France), MO – 20 (USA), Nico (Romania). The main fertilizers were phosphorus and potassium at a stocking rate of 40 kg/da active substance and pre-sowing with $N_6$ kg/da once. The sowing was spread by hand in a dose of 1.200 kg/day. The grass stand was harvested in the bud-formation period - the beginning of blossoming.

The following indicators were used to determine the economic efficiency: average dry matter yield for the study period (kg/da); production costs (BGN/da), gross output, (BGN/da), net income (BGN/da), cost price (BGN/kg), profitability rate. The economic efficiency of the costs was based on data on the economic indicators. The economic indicators were determined on the basis of the activities carried out, indicated in technological maps and the obtained dry matter yield. The calculations were made according to prices for the relevant year of production.

Statistical processing of the data was carried out by ANOVA, determining: variation coefficient (CV,%), standard deviation (SD), minimum (min) and maximum (max) limit values.

## RESULTS AND DISCUSSIONS

The dry matter yield shown in Table 1 fluctuates widely, both by year and averaged over the period. The productivity of the cultivars in the first year shows significant differences. This is evidenced by the highest degree of variability relative to the value of the variation coefficient (CV=25.39) and standard deviation (SD=102.46). Madison variety stands out with a significantly higher dry matter yield compared to the standard, which forms a yield of 608.58 kg/da. The Kalo cultivar showed a yield below that of the standard, whereas the Lot cultivar was close

to the value of the standard. All other cultivars significantly exceed the productivity of the standard. The obtained significant differences in yield and its lower values compared to the other two years are due to its slower growth and development in the year of sowing.

In the second experimental year, all tested cultivars exceeded the productivity of the standard. Again, the Madison cultivar showed the highest productivity, and a yield close to that of the standard was reported for the Lot and Nico cultivars. The degree of variability was very low, according to the value of the variation coefficient (CV=5.64) and standard deviation (SD =88.88). The low variation coefficient is due to the insignificant difference between the minimum and maximum yield values. In the third year, the tested cultivars retain a relatively high value for this indicator. Bursztym cultivar gave a yield of 1,163.15 kg/da. The degree of variability was average (CV=17.29) with SD=163.12 and mean x=943.23.

On average for the study period, the Madison cultivar realized the highest productivity (1,073.32 kg/da). The coefficient of variation (CV=9.83) was low with mean value (x) of dry matter yield for the experimental period 928.86 kg/da and standard deviation SD = 91.29. Since the coefficient of variation is lower than 30%, the yield results are acceptable, which proves the effect of growing the cultivars under the conditions of the light gray pseudopodzolic soils and the climatic conditions under which the research experiment was carried out. These results show that when applying the same cultivation technology for bird's-foot-trefoil cultivars, the proposed approaches can be applied to estimate expected yields of these cultivars in subsequent years and variation from the average dry matter yield and standard deviation. This will determine which cultivar's productivity will have a larger standard deviation and which cultivar's yields will be more variable than their mean. This will contribute to the correct determination of the cultivar structure in the production of bird's-foot-trefoil as fodder.

Table 1. Dry matter yield of bird's-foot-trefoil cultivars (kg/da) by year and average for the period and statistical analysis of the yield (variation coefficient, standard deviation, mean value, minimum and maximum values)

| Cultivars | 2013 | 2014 | 2015 | Average for the period |
|---|---|---|---|---|
| | kg/da | kg/da | kg/da | kg/da |
| Targovishte 1 | 347.31 | 1,467.03 | 812.43 | 826.20 |
| Bursztym | 396.09 | 1,624.83 | 1,163.15 | 1,017.12 |
| Kalo | 280.94 | 1,587.23 | 1,146.92 | 961.89 |
| Lot | 360.82 | 1,519.06 | 827.49 | 851.12 |
| Madison | 608.58 | 1,741.14 | 1,002.20 | 1,073.32 |
| MO | 432.79 | 1,563.10 | 762.14 | 882.39 |
| Nico | 398.68 | 1,527.70 | 888.31 | 890.00 |
| x | 403.60 | 1,575.73 | 943.23 | 928.86 |
| SD | 102.46 | 88.88 | 163.12 | 91.29 |
| CV | 25.39 | 5.64 | 17.29 | 9.83 |
| min | 280.94 | 1,467.03 | 762.14 | 826.20 |
| max | 608.58 | 1,741.14 | 1,163.15 | 1,073.32 |

Source: Churkova, 2019 [4].

The Table 2 and Figure 1 of economic indicators shows production costs, gross revenues, gross profit and profitability. The production costs have almost similar values for the studied cultivars because of the applied identical production technology. They vary from 64.29 to 64.89 BGN/da.The highest gross profit was recorded for the Madison cultivar (136.22 BGN/da). Targovishte 1, as the lowest productive cultivar, realized the lowest gross profit (BGN 93.32/da). A high gross profit is also achieved by the Bursztym cultivar (126.28 BGN/da). The high gross profit in these two cultivars is an indicator of

high economic efficiency in fodder production. This makes Madison and Bursztym cultivars economically efficient for cultivation on light gray pseudopodzolic soils in mountain areas. Gross revenue indicators are similar to these indicators. The highest productivity and the highest gross profit of the Madison and Bursztym cultivars also determine the highest values of their gross revenue.

Table 2. Production costs and cost price in the fodder production from bird's-foot-trefoil cultivars on average for the period 2013-2015

| Cultivars | Production costs | Cost price |
|---|---|---|
| | BGN/da | BGN/kg |
| 1. Targovishte | 64.29 | 0.0778 |
| 2. Bursztym | 64.76 | 0.0637 |
| 3.Kalo | 64.63 | 0.0672 |
| 4.Lot | 64.35 | 0.0756 |
| 5.Madison | 64.89 | 0.0605 |
| 6.MO | 64.4 | 0.0730 |
| 7.Nico | 64.44 | 0.0724 |
| | | |

Source: Own calculations.

Through the gross profit, the necessary information is obtained about the achieved economic effect of the fodder production from the studied cultivars, but the measurement of the economic efficiency requires a comparison of the effect with the production costs incurred to achieve it. That is why the profitability rate is a basic economic indicator, summarizing the economic evaluation of the cultivation of the cultivars under specific soil and climate conditions. The high gross profit in the production of fodder from the Madison and Bursztym cultivars and their productivity determine their high profitability rate, which is 209.92 and 195.00%, respectively. The lowest yield was recorded for the Targovishte 1 (826.2 kg/da), the lowest values of gross revenue (157.61 BGN/da), gross profit (93.32 BGN/da) and profitability (145.15%).

From the economic indicators presented, determining the economic efficiency of fodder production from bird's-foot-trefoil cultivars, it can be seen that the Madison and Bursztym cultivars realize the highest dry matter yield, the highest gross revenue, gross profit and profitability (209.92 and 195.00%).

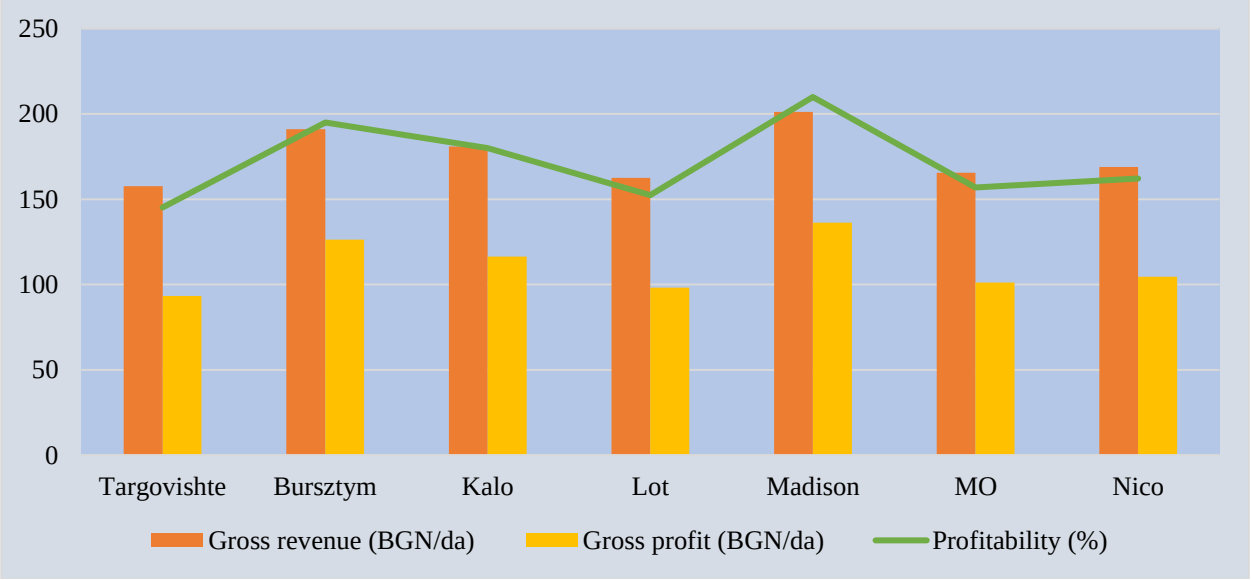


Fig. 1. Economic indicators in the fodder production from bird's-foot-trefoil cultivars on average for the period 2013-2015

Source: Own calculations.

This defines them as economically efficient for inclusion in the cultivar structure of the fodder production under mountain conditions. The cost price of the fodder production (Table 2) depends on the level of dry matter yields for the different cultivars and the amount of production costs. The lower the cost price, the greater the savings inraw materials and

materials, and it reduces the financial means of the production process. The low cost price determines the low price of the fodder production. Of the seven bird's-foot-trefoil cultivars tested, the highest cost price of the obtained fodder production was registered for the standard cultivar (0.0778 BGN/kg), and the lowest for the Madison and Bursztym cultivars (0.0605 and 0.0637 BGN/kg). Cost price depends on the amount of dry matter yield and the production costs incurred, as the highest production costs explain the lowest cost of dry matter yield for Madison cultivar. The difference in the values of the cost price follows the same trend as in the production costs, because of the similar data obtained for the individual cultivars. The lower values of the cost price of the realized fodder production predetermine the receipt of a higher gross profit. This explains the highest gross profit obtained from the fodder production of Madison cultivar.

Table 3. Economic efficiency in the production of fodder of different bird's-foot-trefoil cultivars on average for the period 2013-2015

| **Cultivars** | **Coef. of efficiency (%)** | |
|---|---|---|
| 1. Targovishte | 3.80 | 100.00 |
| 2. Bursztym | 4.63 | 121.84 |
| 3.Kalo | 4.50 | 118.42 |
| 4.Lot | 3.90 | 102.63 |
| 5.Madison | 4.61 | 121.32 |
| 6.MO | 3.87 | 101.84 |
| 7.Nico | 4.04 | 106.32 |

Source: Own calculations.

Efficiency coefficient is an expression of the economic efficiency of fodder production, expressed through the ratio of revenue and expenses. The difference between the values of the efficiency coefficients in the production of fodder for the individual cultivars is insignificant (Table 3). It varies from 3.80 to 4.63%, with minimum and maximum values for Targovishte 1 and Madison cultivars. The efficiency ratio of the research experiment performed follows the trend of the production cost and cost price. The values of the efficiency coefficient (4.63%) for Bursztym cultivar and 4.61% for Madison cultivar prove the effectiveness of their cultivation under the soil and climate conditions of Bulgaria. The higher efficiency coefficient determines their better adaptability. The fertilizing method increases the opportunity to obtain a high yield and ecologically clean fodder production from the various bird's-foot-trefoil cultivars. The obtained higher efficiency coefficient according to the economic indicators defines these two cultivars as more profitable to grow compared to the other tested bird's-foot-trefoil cultivars.

## CONCLUSIONS

In the present scientific research experiment, an economic evaluation of fodder production from seven cultivars of bird's-foot-trefoil grown under mountain conditions is presented. All tested cultivars were found to be suitable for cultivation because of the extremely low variability of dry matter yield between individual cultivars by year.

From an economic point of view, Madison and Bursztym cultivars are the most suitable for inclusion in the structure cultivars in the production of bird's-foot-trefoil fodder. They realize fodder production at the lowest production costs, high gross profit and the lowest cost price. Their highest efficiency ratio makes them extremely profitable for implementation in agricultural production and they are recommended for cultivation in practice.

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# ECONOMIC ANALYSIS AND ECOLOGICAL EFFECT OF FERTILIZING WITH ORGANIC PRODUCTS ON NATURAL GRASSLANDS UNDER THE CONDITIONS OF BIOLOGICAL FARMING

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***Abstract***

*During the period 2013-2015, boron, molybdenum and phosphorohumate and their impact on the economic analysis and ecological efficiency of the obtained fodder production were tested on natural grassland of Chrysopogon gryllus type. Based on a comparative evaluation of the main economic indicators of different types of fertilizers and dry matter yield per decare, it was found that foliar treatment of natural grassland of Chrysopogon gryllus type with boron and molybdenum humate had a positive effect on dry matter productivity.The imported molybdenum humate realized the highest revenues and gross profit and determined these two bioproducts as the most economically efficient for obtaining high yield and quality of fodder. The ecological effect of foliar treatment with biofertilizers significantly affects the floristic composition of the grassland, reducing the share of the main species Chrysopogon gryllus and motley grasses in the formed aboveground mass and increased the share of Agrostis capillaris and legume meadow grasses, such as Trifolium campestre and Lotus corniculatus.*

***Key words*****:** *natural grasslands, fertilizing, economic analysis, ecological effect*

## INTRODUCTION

Natural grass associations are a huge natural resource that allows full, environmentally friendly and low-cost breeding of ruminants. Fodder production can be economically profitable provided that all agrotechnical events are applied in accordance with the requirements of grassland, in optimal terms, doses and norms, and the obtained yields are high enough to ensure production profitability (Georgiev et al., 2005) [6].

Natural meadows and pastures preserve much of the biodiversity of each country. Their use can be considered as a factor in maintaining the biological balance in nature (Kirilov, 2016) [9], as well as by the species involved in the grass composition (Hopkins and Holz, 2006; Iliev, 2014) [7, 8]. The content of protein, fat, crude ash, calcium and phosphorus in the fodder leads to the production of livestock products of extremely high quality (Stoeva and Vateva, 2011) [13].

Recently, the requirements for stable crop production have been constantly increasing, as they are associated with reduced investment in pesticides and mineral fertilizers and increased biodiversity. These conditions determine the integration of environmental aspects into the EU's Common Agricultural Policy (CAP). EU Directive 2092/91 enshrines biological farming as a low-investment production system.

Higher environmental efficiency can be achieved through limited mineral fertilizing and optimization of pesticide costs. This requires the implementation of effective measures and mechanisms for increasing productivity and reducing unwanted investments.

The changes that have taken place in the production of plant and animal products and especially in the prices of the material costs of production require its rethinking from an economic point of view. In a market economy, competition requires manufacturers to demand new technological solutions that lead to increased productivity, lower cost price and greater profitability and efficiency of production.

One of the strategies for the development of the agricultural sector is the use of foliar fertilizers and biostimulants, which affect the biological potential of plants, replace mineral

fertilizing and are an alternative to organic and sustainable agriculture (Mihova et al., 2017;Yakimov and Ivanov, 2017)[11, 18]. Their effect is associated with the stimulation of a number of processes in the plant organs, which leads to full absorption of nutrients and resistance to adverse climatic conditions (Doyle and Toop, 2004; Yakhin et al., 2017)[5, 17]. Their ecological impact is based on the ability of biological products to increase plant viability by reducing the amount of fertilizers used.

The introduction of biofertilizers containing humic and fulvic acids (Vasileva, 2008)[14] is an important element of the technology aimed at creating favorable conditions for the realization of the potential of plants and fodder quality. The stimulating effect of humate fertilizers on the growth and development of plants, the content of crude protein (Vasileva and Kostov, 2015)[16], macronutrients and water-soluble sugars in the aboveground biomass of plants (Vasileva and Ilieva, 2015)[15], as well as increasing the digestibility of dry and organic substance, gross and metabolic energy of fodder (Klimas et al., 2010)[10] determine the need for the application of these biofertilizers in modern production.

The economic efficiency of grasslands depends on the costs and returns associated with dry matter production and the nutritional value of the fodder (Omokanye et al., 2019)[12].

There are few research experiments on the significance of fertilizing with bioproducts of natural grasslands and their impact on biodiversity conservation. So far, no comprehensive assessment has been made from an economic and environmental point of view to determine the impact of fertilizing on the production of fodder from natural grasslands, the amount of production costs, profitability and cost-effectiveness and its role as an environmental factor.

## MATERIALS AND METHODS

The experiment was conducted in the period 2013 - 2015 at an altitude of 500 m in the area of Makaravets with 5 different variants of fertilizing on natural grassland of *Chrysopogon gryllus* type.

The experiment is based on the block method in four replications with a plot size of 5 $m^2$. The treatment was carried out in May and the mowing in July.

The fertilizing variants studied in the experiment are presented in Table 1.

Table 1. Variants and fertilizing doze

| ***Variants*** | ***Fertilizing doze*** |
|---|---|
| 1.Control (C) | Without fertilizing |
| 2.Phosphorus humate (PH) | 300 ml/da |
| 3.Boron humate (BH) | 160 ml/da |
| 4.Molybdenum humate (MH) | 160 ml/da |
| 5.Phosphorus humate (PH) + Boron humate (BH) + Molybdenum humate (MH) | 200 ml/da + 100 ml/da + 100 ml/da |

Source: Churkova and Churkova, 2022 [4].

The biological preparations included in the experiment (organic and organo-mineral fertilizers) are outlined as promising biotechnologies for agriculture, which are produced by AgroBioStim Ltd. in Kavarna.

The economic assessment is established on the basis of detailed technological maps developed for each fertilizing variant. The valuation of the seeds, fertilizers, materials, mechanized and hand labour used in the technology for calculation of the total production costs was performed at market prices as in 2016. The maintenance and haymaking were carried out with own mechanized equipment. The value of production was calculated on the basis of average prices for the analyzed period.

The main indicators determining the economic evaluation of the results of the experiment are gross revenues (BGN/da) and profitability (%) (Borisov & Dinceva, 2014)[3]. They give an idea of the economic efficiency of the applied types of bioproducts and doses of them.

The economic assessment was developed on the basis of total yield. The dry matter yield (kg/da) was recorded over the years and for the period for each variant of each replication by drying the average samples (200 g) under laboratory conditions to constant weight at 105°C. It was calculated on the basis of green matter yield and dry matter content.

Research indicators are: production costs (BGN/da) and gross profit (BGN/da) (Atanasov et al., 2016) [2].

The ecological effect of fertilizing was determined by the botanical composition of the grassland, as its components were divided into groups: grasses, legumes and motley grasses (%), and the groups were determined by species. Based on the obtained results, the impact of fertilizing on biodiversity conservation was determined as an assessment of the ecological effect.

Statistical processing of dry matter yield data was performed by variance analysis (ANOVA) to establish the reliability of ***LSD*** differences.

## RESULTS AND DISCUSSIONS

The presented yield is on average for the three-year study period and on this basis all economic indicators listed in table are calculated (Figure 1). Fertilizing with Molybdenum humate at a dose of 160 ml/da showed the highest effect on dry matter yield, exceeding the control by 19.9%. The combined application of the three fertilizers registered a weaker effect on the yield compared to boron and molybdenum humate imported alone. The result of fertilizing by Phosphorus humate and the combination Phosphorus humate 250 ml/da + Boron humate 100 ml/da + Molybdenum humate 100 ml/da grassland is almost similar and lower than the untreated control.

Production costs (Figure 1) show an increase from 6.04 BGN/da to 11.64 BGN/da in the studied fertilizing variants compared to the control, which is 4.80 BGN/da. The analysis of the structure of the average annual costs shows that the price of bioproducts, the dose of their application and the price of fuel are decisive in the values of production costs. This shows that the costs of organic fodder production depend more on the cost structure than on the amount of fodder production obtained. The costs are mainly due to the activities of purchasing bioproducts and baling hay. Because the harvesting of natural grasslands relies entirely on mechanized activities, much of the cost goes to fuel. In this case, the price of fuel is essential and proving the obtained different values of production costs by options. To some extent, these activities shorten the savings in organic fodder production. Therefore, the production of fodder bioproducts is characterized by an increase in profitability by reducing production costs.

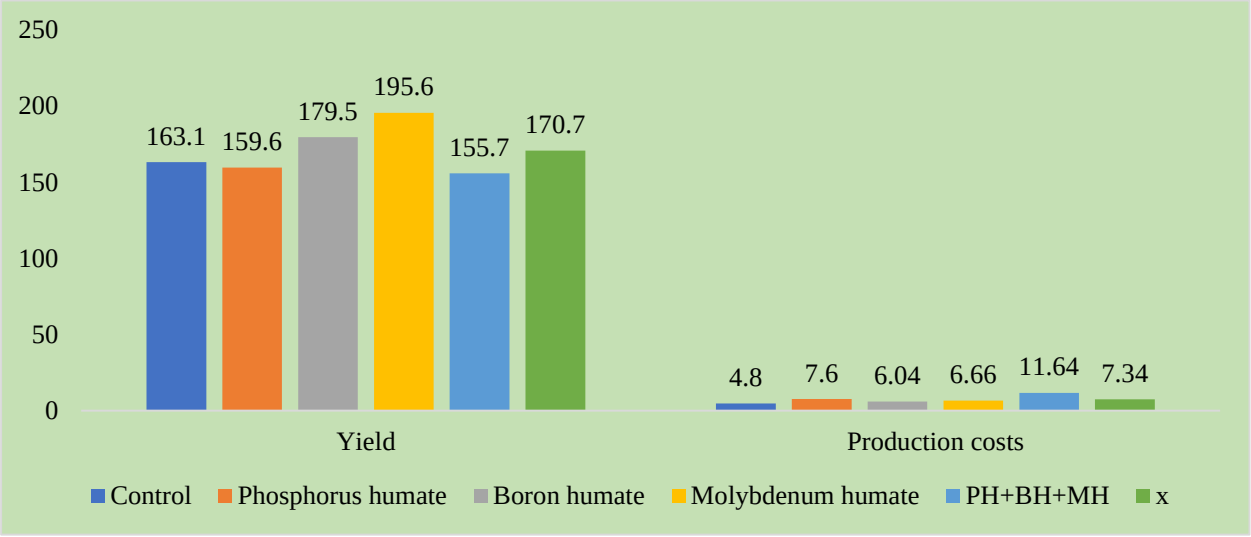


Fig. 1. Yield(kg/da) and production costs (BGN/da) of a natural meadow of *Chrysopogon gryllus* type, treated with humate fertilizers during the period 2013-2015.
Source: data from annual reports on project G 100 of the Bulgarian Agricultural Academy and own calculations.

Cost price (Table 2) is one of the main indicators for determining the economic efficiency in the production procedure for realization of production from natural

grasslands. The production of hay from bunch meadow grasses depends on the costs invested in the application of bioproducts, mowing, baling, transportation. Cost price fluctuates within the narrowest limits between the studied variants of self-imported biofertilizers and varies from 0.035 to 0.075 BGN/kg.

Cost price of the produced fodder production for bunch grass meadow, fertilized with Phosphorus humate 250 ml/da + Boron humate 100 ml/da + Molybdenum humate 100 ml/da was the highest, respectively 0.075 BGN/kg. The increase in cost price is explained by the obtained low dry matter yield, as well as by the negative impact of the increased production costs. As the production of fodder from natural grassland is linked to more mechanized production procedures, the production costs determine the lower cost price of fodder. After the unfertilized control, in which the lowest cost price of the treated hay (0.030 BGN/kg) was reported, from the variants with applied organic fertilizing the lowest was the cost price of grassland fertilized by boron humate (0.035 BGN/kg).

Table 2. Cost price of production of a natural meadow of *Chrysopogon gryllus* type, treated with humate fertilizers during the period 2013-2015

| *Variants* | *Cost price BGN/kg* |
|---|---|
| 1.Control (C) | 0.030 |
| 2.Phosphorus humate (PH) | 0.048 |
| 3.Boron humate (BH) | 0.035 |
| 4.Molybdenum humate (MH) | 0.036 |
| 5.Phosphorus humate (PH) + Boron humate (BH) + Molybdenum humate (MH) | 0.075 |

Source: own calculations.

Data on the cost price of fodder production resulting from the applied humate fertilizers could be explained by the structure of production costs. The very technological process of surface and basic improvement of natural meadows allows the inclusion of a large number of mechanized processes in the production of fodder, which in turn reduces the complexity of obtaining organic products. The costs for bioproducts are relatively constant by years and the highest, but they directly affect the production of higher yields and lower production cost price. It is necessary to work in the direction of increasing the cost of biological fertilizers, increasing the processes of mechanization in the production activity, as a result of which the productivity and quality of the obtained fodder production will increase. The application of a set of measures including meeting the needs of plants with appropriately applied cultivation technology can lead to economic efficiency of the applied biofertilization.

Increased revenue growth (Figure 2) is observed in treatment with Molybdenum humate, as it reflects the highest yield. Only fertilizing with Phosphorus humate + Boron humate + Molybdenum humate tends to decrease revenues - 28.03 BGN/da compared to the variant without fertilizing (control) - 29.35 BGN/da. The data show that the increased volume of fodder production has a positive effect on revenues. The highest efficiency was in the biologically obtained fodder after fertilizing with molybdenum and boron humate, as the increase in the revenues compared to the control was by 5.86 and 2.96 BGN/da.

The amount of gross sales revenue from hay when fertilizing with these two organic products determines the higher economic efficiency compared to fertilizing with phosphorus humate and the combination of the three organic products. The total value of the received revenues from the realized bioproduction of fodder in all variants of fertilizing was higher than the amount of the made production costs, as they were formed only from sales revenues. Their sales price was relatively good, the value of production costs was low and covers the revenues received.

The gross profit (Figure 2) is a result of the revenues and expenses realized during the studied period, made during fertilizing with humate fertilizers and gives an idea of its exact amount. It is an absolute indicator and characterizes the result of fertilizing in quantitative terms. Calculating the exact amount of profit from biofertilizing in fodder production is of great practical significance, as it is the source for paying costs, covering annual taxes and fees and for making new

investments in economic activity. The calculation of gross profit is one of the most important concepts for organization and management in the production of fodder from natural grasslands.

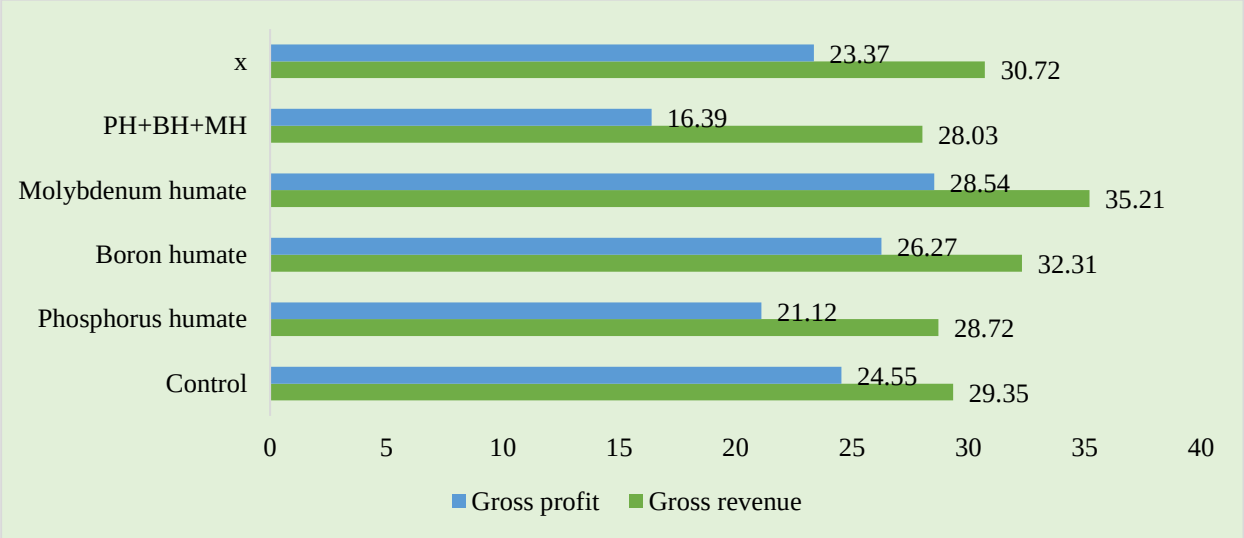


Fig. 2. Gross revenue (BGN/da) and profit (BGN/da) of production of a natural meadow of *Chrysopogon gryllus* type, treated with humate fertilizers during the period 2013-2015.
Source: Own calculations.

The analysis of the impact of production costs and gross revenues shows that an increase in gross profit of 28.54 BGN/da was observed when using Molybdenum humate at a dose of 160 ml/da. Only in the case of the combination of fertilizers (fifth variant) a significantly small value of the gross profit was reported compared to all other variants, namely16.39 BGN/da. Even the control (first variant) had a higher profit - 24.55 BGN/da. Fertilizing with Phosphorus humate at a dose of 300 ml/da is also characterized by a low profit - 21.12 BGN/da, which is lower than that of the control. Fertilizing with Boron humate at a dose of 160 ml/da shows a tendency to increase the profit compared to the first, second and fifth variant of fertilizing. The gross profit of the sold fodder could be higher, as in this case the bioproduction is realized at prices of its conventional equivalents. The fluctuation in the prices of fodder from natural grasslands, obtained as a result of applied biofertilizing and the lack of precisely established ones, mainly leads to serious negative consequences on the final result of the fodder production.

Profitability (Table 3) is a summary indicator of economic efficiency and is a numerical expression of the percentage ratio between gross profit and production costs. Significant differences were observed in terms of the profitability rate, as it was the highest in the control variant (without fertilizing) with 523.04%. This is due to the low investment compared to all other variants. It is followed by the profitability rate using boron humate (160 ml/da) with 447.09% and that of feeding with Molybdenum humate (160 ml/da) with 438.66%.

Table 3. Profitability of production of a natural meadow of *Chrysopogon gryllus* type, treated with humate fertilizers during the period 2013-2015

| *Variants* | *Profitability %* |
|---|---|
| 1.Control (C) | 523.04 |
| 2.Phosphorus humate (PH) | 278.54 |
| 3.Boron humate (BH) | 447.09 |
| 4.Molybdenum humate (MH) | 438.66 |
| 5.Phosphorus humate (PH) + Boron humate (BH) + Molybdenum humate (MH) | 141.71 |

Source: own calculations.

They are followed by Phosphorus humate (300 ml/da) with 278.54%. The lowest profitability was observed in the last (fifth) variant, namely 141.71%, i.e. the least

effective variant.

The economic efficiency of the bioproduction of fodder production of bunch type natural grassland depends on a complex of factors, such as gross profit and production factors. According to data obtained from Agapieva-Aliosman (2019) [1], the profitability rate determines the degree of return on equity. The higher profitability rate as a result of fertilizing with boron and molybdenum humate allows for the realization of expanded reproduction, which outlines a correct direction of the technology for the production of bio fodder production. The analysis of data shows that the efficiency of the bio fodder production obtained as a result of fertilizing with bioproducts increases with the rise of the gross profit per unit of fodder obtained and the reduced production costs. The dynamics of change in the value of gross profit depends on the degree of change in the average dry matter yield, production costs and sales prices by year. The data show that these three components are extremely dynamic over the years of the experimental period and have a different impact on the gross fodder production per decare. The favorable combination of increased dry matter yield, increase in the purchase prices of hay and reduction of production costs determine and prove the obtained high profitability rate in fertilizing with boron humate. This gives us reason to recommend the fertilizing with boron humate at a dose of 160 ml/da, as an economically effective measure of the technology for receiving fodder production by natural grassland of *Chrysopogon gryllus* type.

***Ecological impact***

Vegetation in natural meadows and pastures is of interest in terms of its specificity, diversity of plant communities and floristic richness. It is highly vulnerable to ongoing global climate change and anthropogenic interference. Communities that are distributed in areas with insufficient moisture are adversely affected by climate drought processes, and changes in pasture load are another factor that affects grass vegetation in these areas. This necessitates the development of appropriate measures to maintain their favourable condition. One of these measures is the fertilizing of natural grasslands with bioproducts and determining their impact on biodiversity conservation, as an assessment of the ecological effect.

The treatment with humate fertilizers was reflected differently during the years of the experimental period, which is evident from the botanical composition of the grassland presented in Fig. 3.

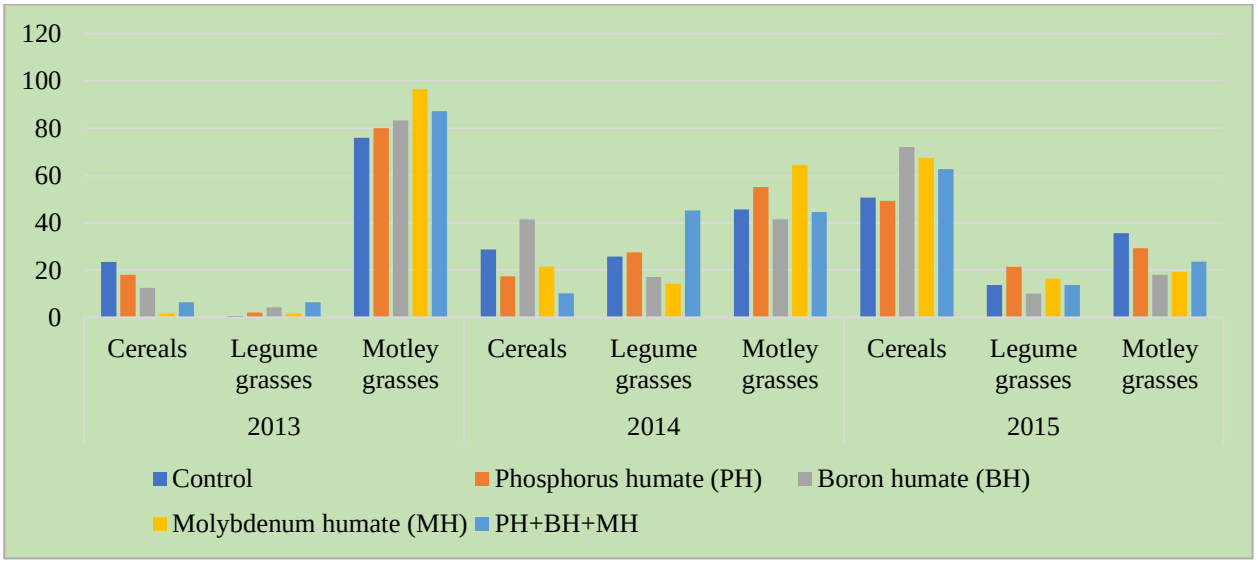


Fig. 3. Botanical composition of a natural meadow of *Chrysopogon gryllus* type, treated with humate fertilizers during the period 2013-2015.

Source: data from annual reports on project G 100 of the Bulgarian Agricultural Academy.

In the first year of the experimental period, the natural grassland cover was dominated by motley grasses, which participated with a share from 76.0 96.6 to 84.6% in the composition of the natural grassland. Grass components predominated in the grassland (from 1.7 to 18.0%) over legumes, whose relative share was from 0.6% in the unfertilized control to 6.4% in the combination of phosphorus humate + boron humate + molybdenum humate. Grass species are presented by *Agrostis capillaris*, *Bothriochloa ischaemum*, *Chrysopogon gryllus*, *Festuca ovina*), and legume species by *Trifolium campestre*, *Lotus corniculatus*.

The treatment with humate fertilizers had a smaller effect on the relative share of grass species, which is evident from their smaller share in the composition of the grass mass compared to those in the control. Legumes fertilized with Molybdenum humate were 1.7%, and those with the combination Phosphorus humate + Boron humate + Molybdenum humate were 6.4%, compared to 0.6% for the control. In the second experimental year, the composition of the natural grassland was dominated by grass components, such as *Agrostis capillaris* L., *Bothriochloa ischaemum* L., *Chrysopogon gryllus* L., *Festuca ovina* L., *Anthoxanthum ododratum* L., *Holcus lanatus* L., *Cynosurus cristatus* L., and legumes species, such as *Trifolium campestre* L., *Lotus corniculatus* L., *Vicia sativa* L., motley grasses share is reduced compared to the first year and is from 41.5% to 64.4%. Meadow grasses predominated compared to the control in the variant treated with boron humate (41.4%). Phosphorus humate (300 ml/da) and the combination of humate fertilizers (Phosphorus humate250 ml/da + Boron humate100 ml/da + Molybdenum humate100 ml/da) positively affected the share of legumes and increased their participation in grassland respectively from 27.5% to 45.2%.

The effect of the imported humate fertilizers in the third experimental year was very well expressed. A variety of meadow grass species was observed. Of interest is the displacement of *Chrysopogon gryllus* L. by *Bothriochloa ischaemum* L. and *Agrostis capillaris* L. The highest percentage share of *Agrostis capillaris* was observed in the unfertilized control and the lowest in the variant with combined action of humate fertilizers. Phosphorus humate determines the percentage share of species in the composition of the grassland.

*Bothriochloa ischaemum* L. predominates in grassland, as it was fertilized with Molybdenum humate and the combination of Phosphorus humate + Boron humate + Molybdenum humate. Fertilizing with humate fertilizers had an extremely favorable effect on the relative share of legume components in the grassland, with *Lotus corniculatus* L., *Trifolium campestre* L., *Trifolium pratense* L. and *Vicia sativa* L. predominating. Phosphorus humate determined a share of up to 21.4%. Bird's-foot-trefoil dominated the grassland, as Molybdenum humate increased its share. In the group of clover, except for *Trifolium campestre* L., no other representatives were found. The presented botanical composition of the grassland proved the stimulating effect of humate fertilizers expressed by reducing the degree of weed infestation and increasing the share of legume components in the grassland. In this way, the role of biofertilizers for conservation and improvement of biodiversity is determined by increasing the useful species in natural grasslands, which determines the environmental benefits of this technological solution.

## CONCLUSIONS

The foliar treatment of natural grassland of *Chrysopogon gryllus* type with boron and molybdenum humate had a positive effect on dry matter productivity. The impact of other humate products was less pronounced, as the probable reason for this was the specific interactions between the specific climate conditions during the year, the type of grassland, the fertilizing rate and the method of fertilizer application.

Fertilizing a natural grassland of *Chrysopogon gryllus* type with boron humate at a dose of 160 ml/da of showed the lowest production costs, the lowest cost price and the highest profitability rate in the production of fodder.

The imported molybdenum humate realized the highest revenues and gross profit. The obtained results determine thefertilizing with these two bioproducts, used as individual preparation, as the most economically efficient for obtaining high yield and quality of fodder from natural grasslands.

The ecological effect of foliar treatment with biofertilizers had a significant effect on the floristic composition of the grassland. The percentage and species share of the main biological groups (grasses, legumes, motley grasses) in the natural grassland was changing positively. There was a reduced presence of the main species *Chrysopogon gryllus* L. (characterizing the grass community) and motley grasses in the formed aboveground mass. The share of *Agrostis capillaris* and legume meadow grasses (*Trifolium campestre* L. and *Lotus corniculatus* L.) significantly increased, which suggests better qualitative indicators of grass biomass.

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# ORGANIC FARMING SUPPORT POLICY IN MOLDOVA

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***Abstract***

*In Moldova, the adoption of the Law for Ecological Agri-Food Products (2005) and the Law on Subsidizing Principles in Agriculture and Rural Development (2016) contributed to the beginning of government support for organic farming.The objective of this paper is to examine the influence and effectiveness of support policies for the growth of organic farming. The legal documents for the programs and policies adopted are the framework for the data analysis. Secondary data from the Agency of Interventions and Payments in Agriculture (AIPA) regarding the number of applications, converted area, and analysis of allocated subsidies for organic agricultural development were used for the impact analysis. Due to differences between national legislation and European policies, local ecological certificates are not recognized on the E.U. market, which creates challenges for export under the organic label. This is a major issue for the development of organic farming in Moldova. The lack of control capacity of conversions, certification of technologies, raw materials and organic products, and few professional trained workers in organic agriculture cause additional problems to farmers restricting the expansion of ecological agriculture in Moldova.*

***Key words*****:** *ecological agriculture, organic farming, subsidies*

## INTRODUCTION

Agricultural policy nowadays is focused on sustainability. Agricultural sector is challenged by a high demand from larger world population on one side and lowering the negative impact on environment. The impact of the agricultural sector of environment was highly discussed in different studies [2, 8, 13]. Organic farming is a key to sustainable agriculture and low negative consequences for environment.

The Common Agricultural Policy of E.U. has as major objectives sustainable food production, sustainable management of resources and well-balanced territorial development. The E.U. agricultural policy from environmental perspective supports and promotes the development of organic agriculture in European member states. E.U. member states have an average 8.5 percent of agricultural land converted in organic farming. The target proposed by European Commission is to reach 25 percent by 2030.

Nevertheless, some E.U. countries have its own government target of organic farmland. Some countries as Spain, Bulgaria, Estonia, Netherlandshave no target set by government for organic farm, while Austria and Germany plan to reach 30 percent by 2030. Organic farming is the key element into Common Agricultural policy objectives, as part of environmental and climate challenges [11].

Moldova has favorable conditions to develop organic farming. Despite this, Moldova's organic farming area has shrunk; today, only 1% of the country's total agricultural land is used for ecological farming [3,14]. Since 2005, when Law No. 115 regarding ecological agri-food products was adopted, the government has been promoting the promotion of organic agriculture [9]. With the adoption of Law No. 276 in 2016, the government strengthened its assistance for agricultural and rural communities. This law identifies the key areas for supporting development in these sectors [10]. In the sustainable management of natural resources priority, the support to promote and develop organic farming in Moldova is included [10].Technical rules for environmentally sustainable agri-food production, labeling, and the use of a registered trademark were

adopted by the government in 2008 and 2014 [5, 6].

## MATERIALS AND METHODS

This research aims to analyze the impact and effectiveness of the support policies implemented for the development and expansion of organic farming in Moldova. The analyzed data is based on regulatory documents for programs and policies promoted. The Agency of Interventions and Payments in Agriculture (AIPA) provided secondary data for this study. The impact analysis included data regarding subsidies allocated for the expansion of organic farming, the number of beneficiaries, and the area of land converted to organic farming.

## RESULTS AND DISCUSSIONS

Organic farming was declared a priority by 2030 according to the Strategy of agricultural development and rural areas. It includes the harmonization of national legislation to European regulations and organic farming is a specific objective. The goal is to encourage the growth of extensive, environmentally sustainable agriculture that preserves biodiversity, maintains fertile soils and water sources, and enhances the land for long-term soil management. Implementing measures to stop the degradation of agricultural land as well as boosting resilience and adaptability to the effects of climate change are part of this [12].

The development of the organic farming sector aims to reduce the agri-food system's impact on the environment and climate by maintaining long-term soil fertility, increasing biodiversity and a non-toxic environment, contributing to high animal welfare standards, enabling the transition to competitive sustainability from farm to fork that can once guarantee food security in the context of climate change and decline biodiversity.

Through several institutions, such as the Organization for the Development of Entrepreneurship (ODE), the Investment Agency, and the Agency for Intervention and Payments in Agriculture (AIPA), the government supports organic farming and food production. One of the programs – "The Greening Program" developed by ODE, is designed especially for small and medium-sized enterprises (SMEs) [7]. The greening program was approved in 2019 and aims to foster a business environment that is supportive of the transition away from a consumption-based economic development model and toward one that incorporates "green" economy practices into the production processes of different sectors of the national economy. The program has five specific objectives, namely [7]:

1) increasing the level of information and awareness about the principles of the "green" economy of stakeholders at all levels (local public administration authorities, business incubators and other business and environmental support institutions/organizations, in order to support and promote the implementation of the "green" economy at local and national level;

2) increasing entrepreneurial skills in greening small and medium-sized enterprises for more competitiveness and sustainability;

3) consolidation and development of businesses that introduce eco-innovative products, processes and services, by offering non-reimbursable financial support;

4) stimulating the entrepreneurial environment for the implementation of new business models, created on the principle of pollution prevention, by recovering waste and reusing and/ or recycling it;

5) encouraging the implementation by entrepreneurs of international standards and/or certificates relevant to greening, the European Eco-Management and Audit Scheme and/or the preparation for national and international eco-labelling.

Thus, this Program offers three main benefits for small and medium-sized enterprises (SMEs):

1) stimulating their participation in greening, maximizing the expected impact and reducing pressure on the environment;

2) awareness of the benefits of their greening in relation to the financial and sustainable development of businesses and environmental protection;

3) facilitating the implementation of environmental management systems and eco-labelling to ensure internationalization, export promotion and integration into international value chains.

Governmental support of SMEs includes three levels as: developing informational tools and infrastructure of application; allocated financial support; monitoring the effect and impact of investment.

The financial sources are allocated from the state budget in the form of a grant, with its own contribution of at least 30 percent and the maximum value of the financial support cannot exceed 200 thousand lei.

For the implementation of greening initiatives such as resource efficiency, the use of sustainable production and consumption models, the introduction of eco-innovations into technological processes, waste reduction and management, pollution prevention, water resource management, etc., financial grants are available to small and medium-sized enterprises (SMEs).

Farm technology innovation and sustained agricultural development depend on the efficient allocation of subsidies to farmers.

Hence, increasing the effectiveness of subsidy distribution is essential for ensuring the agricultural sector's long-term sustainability [3].

The current agricultural policy intends to allocate more subsidies to farmers since it encourages investment and the expansion of the agriculture sector.

The principles of subsidization and financial stimulation of investments, particularly those targeted toward the growth of organic agriculture, are regulated by Law Nr. 276/2016 [10].

In addition, Law Nr. 115/2005 [9] supervises the marketing of ecological goods of both plant and animal origin as well as the social contacts involved in getting ecological agri-food items free of synthetic chemicals.

Budgetary financial sources are provided yearly to the National Fund for Agricultural Development and Rural Environment [4] to support investment initiatives carried out by farms and agricultural producers registered in the ecological circuit.

Table 1. Types of granted subsidies to farmers

| **Support types** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** |
|---|---|---|---|---|---|---|
| Post-investment grants | X | X | X | X | X | X |
| Advance grants for the development of start-up projects | | X | X | X | X | X |
| Advance grants for rural development | | | | X | X | X |
| Direct payments per head of livestock | | | | | X | X |
| LEADER approach | | | | | | X |
| Reimbursement of excise duty on diesel used by agricultural producers | | | | | | X |
| Advance grants for land improvements | | | | | | X |

Source: based on data from Agency of Interventions and Payments in Agriculture.

The government uses a variety of subsidy schemes and raises the number of subsidies granted to protect farmers' income and offset expenses incurred from the National Fund for Agricultural Development and Rural Environment.

Subsidies distributed annually by the National Fund for Agricultural Development and Rural Environment, increased by 94.4 percent (in 2022 amounted to MDL 1,750 million).

The most demanded are post-investment subsidies, and the government support provided for organic farms is the most significant in this category.

The post-investment grants, which serve as compensation payments for the lost income and additional expenses spent by farmers who commit to remaining in the organic farming system for at least five years, are available to

agricultural producers who are enrolled in the system.

According to sources [1, 4], farmers are eligible to receive financial support through three types of incentives, which include:

-conversion to organic farming;

-maintaining organic farming for crop production and organic beekeeping;

-and improving soil fertility.

The subsidy allocated per farm is a fixed sum per unit of crop area, which varies depending on the duration of the conversion, to organic farming methods, which can range from one to three years.

It is allocated for different crops as: orchards, vineyards fruit bushes and strawberries; medicinal and ethero olaginous plants, field crops, pastures and wells, vegetables. For beekeeping the conversion period is considered 12 months.

Tomaintain the organic farming practices, the National Fund for Agricultural Development and Rural Environment, reimburses 20% of the sold value of the organic production, according to the invoices presented.

To maintain and intensify the soil fertility,2,500 MDL per hectare is allocated. The financial support shall be granted to farmers who sow nitrogen-fixing crops, intercropping or successive crops, such as: soya, peas, chickpeas, lentils, alfalfa, toddles, vetches, beans, clover, lupin, ryegrass, mustard, buckwheat etc.

The maximum value of the support granted to maintain the organic farming practices for a beneficiary will not exceed the amount of 200 thousand MDL. If the products are sold for two consecutive years, then the maximum allocated amount of subsidy is 400 thousand lei.

To obtain this financial support, farmers must meet several criteria as being registered in organic farming; own agricultural land on which are cultivated certified ecologic crops or are in conversion period; have an agreement with an inspection and certification organization recognized by the Ministry of Agriculture and Food industry etc.

To encourage and stimulate priority agricultural activities, farmers engaged in organic crops or livestock can benefit from increased subsidies by 20% of the amount of the authorized subsidy if they make investments in: the growth of fruits and vegetables in protected ground; the establishment of multiannual plantations; renovation and modernization of livestock farms; the purchase of breeding animals.

Farmers that benefit of subsidies must remain in organic farming at least five years, and the same converted area is not eligible for subsidies allocations twice.

Subsidies allocation for organic farming started being prioritized in 2017 [4]. The allocated funds and number of applicants for receiving a subsidy in organic farming is changeable within 2017-2021 (Table 2).

Table 2. Dynamics of subsidies applications in organic farming

| | **2017** | **2018** | **2019** | **2020** | **2021** |
|---|---|---|---|---|---|
| **Subsidy applications** | 31 | 72 | 76 | 65 | 59 |
| **Approved applications** | 30 | 69 | 67 | 63 | 54 |
| **Share, %** | 97 | 96 | 88 | 97 | 92 |
| **Amount requested-thousands MDL** | 1,880.0 | 7,740.9 | 8,603.7 | 6,901.0 | 7,482.2 |
| **Amount allocated, thousands MDL** | 1,590.2 | 7,251.5 | 7,845.1 | 6,220.3 | 6,733.2 |
| **Share, %** | 85 | 94 | 91 | 90 | 90 |

Source: based on data from Agency of Interventions and Payments in Agriculture.

An explanation of this variations over the analyzed period is because not all farmers that are registered and certified in organic agriculture are applying for 20 percent compensation of the sold output. Also, once benefitting from a subsidy for organic farming is compulsory to remain in ecologic agriculture system for at least five years. This condition does not stimulate organic farmers to apply for subsidies as they are uncertain about fulfilling this requirement.

The number of subsidy applications is in continuous decrease over the last two years (Table 2). In 2021 were submitted 59 applications with a subsidy request of 7,482.9 thousand MDL. From all applications received, 92 percent (54 framers) were

approved to benefit from a subsidy in total being allocated 6,733.2 thousand MDL for ecological agriculture.
Also, the area of agricultural land in conversion for ecologic agriculture is decreasing (Table 3).

Table 3. Area in conversion for organic farming, hectares

| | Conversion period | | |
|---|---|---|---|
| | **I year** | **II year** | **III year** |
| ***2017*** | 1,067.5 | 432.4 | 201.4 |
| ***2018*** | 2,208.3 | 1,407.1 | 289.5 |
| ***2019*** | 1,976.1 | 2,401.9 | 175.7 |
| ***2020*** | 1,500.7 | 2,837.3 | 195.5 |
| ***2021*** | 112.2 | 443.6 | 200.9 |

Source: based on data from Agency of Interventions and Payments in Agriculture.

Analyzing the data for agricultural area in conversion, a large decrease in last two years is observed. During 2019-2020, over 4,500 hectares were in conversion for ecologic agriculture, while in 2021 only 756.7 ha (by five times less) (Table 3).
This decrease in the area of agricultural land in conversion can be due to several factors, namely:
-issues regarding acceptance and equivalence of organic certificates issued by certification bodies in the Republic of Moldova, many operators have ceased their land registration in the national organic certification scheme, applying and obtaining certification from international control bodies, whose certificates are recognized in the E.U.;
-there is no system of access to data from external certified areas and at the moment, attempts to collect this data provide uncertain results;
-the costs of organic products is higher than in conventionally agriculture, while the value of the sold products is lower, often because the appearance of the product may often not be that expected by customer;
-lack of regulatory framework that would provide exceptions or facilities to organic farms;
-lack of a surveillance and control system regarding the traceability of organic agri-food products.
-limited access to financial sources, agricultural holdings cannot obtain subsidies if they are not registered in the national certification system.
In 2021, 54 organic farmers benefited from subsidies and an area of 756 hectares. The largest share in total area under organic farming belongs to multiannual plantations (orchards) - 43 percent (Figure 1).

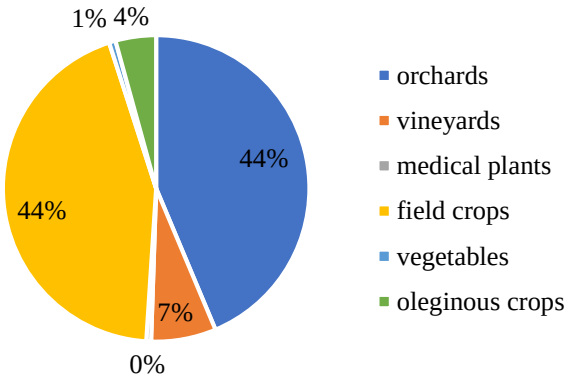


Fig.1. The area of agricultural land in conversion by types of crops, 2021
Source: based on data from Agency of Interventions and Payments in Agriculture.

Also, an important share in total subsidized area under ecological agriculture belongs to agricultural crops – 44 percent, vineyards – 7 percent etc.
The organic farming development In Moldova faces many slowdowns mainly due to lack of qualified and trained specialists in organic agriculture; local certification of organic producers is not internationally recognized which limits the market of organic agriculture; little power and control the converted areas to agricultural farming. One important policy issue is the compliance of local policy and practices regarding organic farming with European regulation.

## CONCLUSIONS

In Moldova, the government supports organic agriculture and organic food production, through various organizations as: the Organization for the Development of

Entrepreneurship the Investment Agency; the Agency for Intervention and Payments in Agriculture.

The greening program promoted by the government through the Organization of Entrepreneurship Development includes various measures to support SMEs and facilitates the implementation of environmental management systems and eco-labelling to ensure internationalization, export promotion and integration into international value chains.

To assure internationalization, export promotion, and integration into global value chains, there are numerous initiatives to promote SMEs as well as facilitate the installation of environmental management systems and eco-labelling.

The National Fund for Agricultural Development and Rural Environment is managed by the Agency of Interventions and Payments in Agriculture, which provides support to farms that have implemented investment projects and agricultural producers registered in the ecological circuit.

The conversion to organic farming, preservation of organic crop production and organic beekeeping, and improvement of soil fertility all benefit from financial assistance.

The organic farming development In Moldova faces many slowdowns mainly due to lack of qualified and trained specialists in organic agriculture; local certification of organic producers is not internationally recognized which limits the market of organic agriculture; little power and control the converted areas to agricultural farming. One important policy issue is the compliance of local policy and practices regarding organic farming with European regulation.

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# ANALYSIS OF ROMANIAN FARMERS TRADING BEHAVIOUR IN THE COMMODITIES EXCHANGE UNCERTAINTY CAUSED BY CLIMATE CHANGE, COVID-19 PANDEMIC AND EXTERNAL MARKET CHANGES

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***Abstract***

*Starting with the summer of 2020, the farms inputs prices, especially for diesel, seeds, fertilizers and pesticides as well as of grains (cereals and oilseeds) started fluctuating excessively. This phenomenon caused great uncertainty in farmers economic activity, especially for the crop farms that are bulk selling all their products to traders. The uncertainty was primarily caused by the overlap of several factors, some of which were more predictable and some of which took everyone by surprise and caused panic and volatility on the stock markets. The unfortunate events sequence began in early 2020, with the outbreak of the COVID-19 pandemic that caused disruptions in supply chains, import-export bans and lockdowns that reduced the consumption of agri-food products in the HORECA industry. For Romanian farmers, the disturbance created by the pandemic also overlapped with the severe drought that affected production levels in 2020 and 2022, as well as with the hostilities in the region which started at the end of February 2022, and led to the agricultural inputs excessive price increase and high volatility on the commodities exchange. In this sequence of unfortunate events, the farmers' decision regarding the stored grains volumes, inputs purchasing timing and grains selling timing, made a major difference for their business' financial stability and profitability.*

***Key words*****:** *trading behaviour, economic uncertainty, drought, profitability, commodities*

## INTRODUCTION

After a long period of approximately 6 years (2014-2020), in which both inputs prices and grains and oilseeds prices did not experience large fluctuations, in the last 3 years, Romanian farmers have had a difficult time finding the most profitable strategy for their business [20].

Especially in crop farms, the cereals selling strategy can make the difference between a profitable year or a year in which costs are barely covered [18].

Following 2007, Romanian farmers benefited from the advantages of Romania's integration in to the E.U. They carried out projects to access the European funds available both during the pre-accession period through SAPARD program and through post-accession programs, National Programme for Rural Development - NPRD 2007-2014, NPRD 2014 – 2020 [14]. They also collected the subsidies for the cultivated areas. This influx of capital helped to develop and modernize Romanian agriculture in the last decade [14]. With the help of these funds, the farmers were able to modernize their machinery, improve their cultivation technologies and become an important player in the E.U. agricultural commodities market [11,13]. Due to the poorly developed livestock sector and the lack of processing capabilities, a large part of the Romanian's grains and oilseeds production is exported, mainly to Egypt, Saudi Arabia and other countries from the Middle-East or even Asia through the Constanța port from the Black Sea [15,16].

Also, during this period, Romanian farmers had to face the fluctuations in the global market of agricultural products and inputs.

The most important fluctuations occurred in 2007-2008 period during the Global Financial Crisis and in 2011-2014 period [3]. Obviously, in both periods the higher incomes obtained from selling cereals at higher prices were necessary to offset the increased fertilizers prices and other categories of agricultural inputs such as fuel and crop protection products.

Also, the increased use of biofuels in the last decade has put pressure on the grains and oilseeds prices [17].

Romanian farmers started to adapt their business to global market demands and tried to reduce the impact of some agriculture risks, respectively, commodities market fluctuations and the persistent drought and increased number of extreme weather phenomena caused by the global warming [2, 8, 22].

During the 2014-2019 period, the absence of major disturbances in the commodity market and a meteorological climate without serious droughts or other helped the Romanian farmers to consolidate and capitalize their businesses [4]. They managed to increase the capacity of their grain storage facilities and they started to use more often the future or forward contracts sale options in their commercial relationship with the main commodities traders. These changes in business approach helped them to reduce their risk with low grain price uncertainty during the harvest period and to obtain better prices in winter or spring when they sold their stored grains [19, 28].

The disturbances that took place in the commodities market in the last three years took many farmers by surprise. Some of them had just started to get used to this trading behaviour and benefit from it. Others were in the first years of implementing risk limit strategies by signing future or forward contracts with traders and by using grains storage. Most of them had contracted loans to finance their investments in storage facilities.

This paper aims to analyse how farmers perceived and reacted to the commodity markets disturbances caused by the COVID-19 pandemic lockdowns and import/export bans and the unexpected hostilities in the region.

Also, the study aims to find out the farmers perspective regarding their business strategy in this context of climatic and socio-economic uncertainty.

## MATERIALS AND METHODS

In this paper creation, both the quantitative research method and the qualitative research method were used.

The quantitative research method is based on the statistical processing and interpretation of data obtained from a questionnaire that was applied on 52 Romanian farmers in 2023 spring.

For the qualitative research, 20 individual interviews were organized with some of the farmers who responded to the questionnaire applied to the quantitative research.

The respondents' farms where split in four main categories depending on their size and their access to grain storage facilities.

The main indicators considered in conducting this study were: farm structure (crops only/mixed farm), farm size, number of employees, land ownership structure, grains storage capacity, crop irrigation percentage, average crop yields, stored production percentage, average storage costs, percentage of contracted production, grains selling time and commodities selling prices.

Study limitations: even if sustained efforts were made to prevent sample error and to ensure that the sample adequately represents the entire population, some non-response error was caused by the relatively small number of farmers that chose to respond the questionnaire.

The questions related to the percentage of the area with available irrigation; the percentage of goods for which futures sales contracts were signed with traders and the percentage of cereals sold in the 2022-2023 period that was split in seasonal categories, the data obtained refer to the percentages of the total area and the percentages of the total production without specifying exactly which crops received the water, in which amount or for what exact type of grain or oilseeds the futures sales contracts were signed and what types of crops were sold in each season category. Unfortunately, these

limitations were necessary due tosome farmers refusal to respond to all questions.
The questionnaire had a complex structure and some farmers did not have the necessary time to accurately respond to all questions. Also, in this study, only the four main crops were considered: wheat, corn, sunflower and rapeseed.
In the crop rotation of some farms, especially in mixed farms, there were also other crops, such as barley, rye, peas, soybeans or alfalfa. Data regarding these crops were not included in the study due to the reduced proportion of these crops in the total cultivated areas.

## RESULTS AND DISCUSSIONS

The results obtained following the questionnaire responses interpretation and interviews transcript analysis can outline the Romanian farmers economic struggle during the last years and their business strategy for the next years.
Romanian agriculture has achieved a significant development in the last decade, the production of grains and oleaginous plants experiencing an upward trend [26].
As shown by the statistical data presented in Figure 1, the yields obtained by Romanian farmers were seriously affected by the droughts that occurred in 2020 and 2022.
Romanian farmers business strategy in the last three years was marked by a whole series of uncertainties, some of them impossible to anticipate, which significantly affected their financial stability and their development perspective.
As can be seen in Figure 2, the price of the main commodities that influence farmers' business has had a high volatility in the last 20 years. The increase in prices caused by the economic crisis of 2008 and the one caused by the COVID-19 pandemic and the hostilities in the proximity represented the greatest risks of destabilization for all farm businesses.

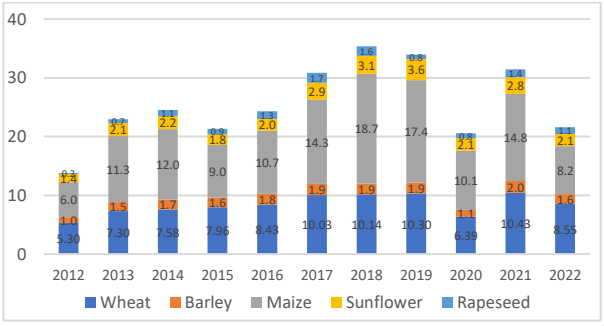


Fig. 1. Evolution of Romania's main crops productions in 2012-2022 period (Mt).
Source: National Institute of Statistics, NIS, Tempo online database [10].

The 2019/2020 agricultural year, represented a turning point in the economic activity of Romanian farmers. This year was marked by a severe drought that affected cereal production, especially for spring crops. Because of the drought, farmers had to sell a large share of their reduced production in the summer, shortly after harvest, in order to pay for their inputs. Therefore, they failed to profit from the increase in grain prices that took place towards the end of 2020.
The drought of 2020 seriously affected the economic stability of all farmers due to low yields, but in particular it greatly affected those who had signed contracts with traders at the beginning of 2020, at lower prices.
At harvest, these farmers had to buy grains from their neighbours at higher prices in order to honour their contracts and to avoid disastrous legal consequences. This event led to a sharp decrease in the number of farmers who signed futures contracts with grain traders in the following years, as can be seen in Fig. 3.
It should be mentioned that in 2020, farmers who were not greatly affected by the drought and managed to obtain normal productions that were stored and sold at the end of 2020 or at the beginning of 2021, obtained higher profits because of reduced fertilizers prices in the previous year that lowered their production costs.

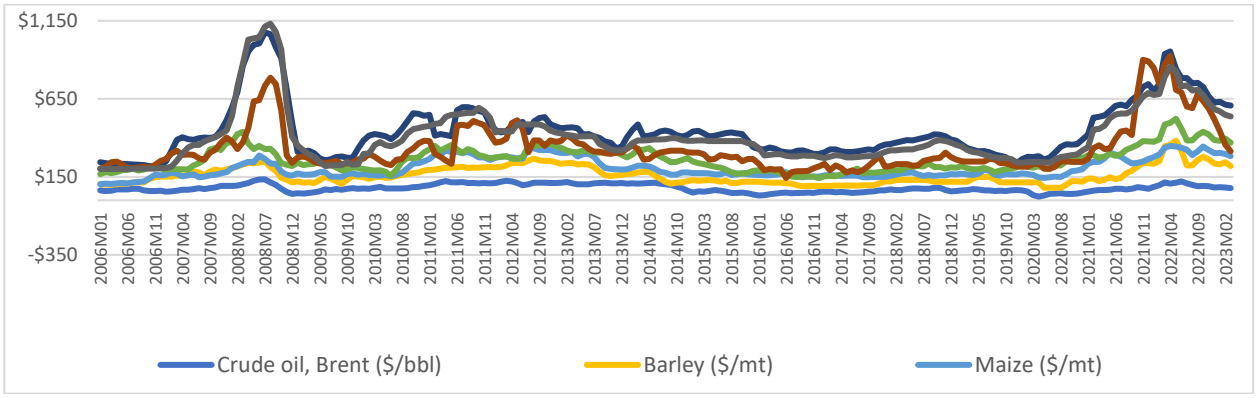


Fig. 2. Commodities prices evolution graph
Source: The World Bank, DataBank database [29].

That year, buying fertilizers early and selling grains late was by far the most profitable strategy for Romanian farmers.

The end of 2020 was characterized by commodity prices increase on the main exchanges, both for grains and oilseeds and for fertilizers.

With the beginning of 2021, amid the disruptions caused by the COVID-19 pandemic, the volatility of commodity prices continued to increase [7].

The general trend was prices increase for most commodities, but, starting from January 2021, a detachment can be observed between the prices of cereals and the prices of fertilizers, in the sense that the price of fertilizers increased much more sharply compared to the grains price. This fertilizer prices increase reduced the 2021 production profit margin, especially for the farmers who signed most of the fertilizers purchase contracts in the spring.

Similar to 2020, farmers who signed the purchase contracts for most fertilizers at the end of 2020, took advantage of better prices for fertilizers.

Following more favorable weather conditions, the summer of 2021 brought agricultural record productions that were significantly higher than in the previous years.

The enlarged crops yield obtained by the majority of Romanian farmers in the summer-autumn of 2021 and the increase in grains and oilseeds prices, helped them to exceed their production costs that increased significantly due to the increased fertilizers prices and to recover their losses caused by the previous year drought.

Regarding the grains' future sale contracts perspective, the farmers who signed the contracts in early spring of 2021 obtained lower prices and implicitly a smaller profit margin, and those who signed the contracts in late spring benefited from higher prices and achieved a higher profit margin.

Farmers who managed to store a share of their production and managed to sell it in the spring of 2022, after the beginning of the conflict in Ukraine, obtained higher prices and managed to obtain some consistent profit margins.

In the 2021/2022 agricultural year, farmers' crops were again affected by drought, especially spring crops, where maize yields decreased by 44.7%.

Some of these economic difficulties that affected crop farms businesses were alleviated by grains and oilseeds price increase that occurred immediately after the war began. Farmers who signed futures contracts with traders between March and mid-June secured the sale of the contracted quantities at record prices for the last 14 years. Even the farmers who did not prefer sign futures contracts, managed to sell their grains at favourable prices at harvest.

As can be seen in Figure 3, after the problems caused by the 2020 drought, the percentage of farmers who signed contracts dropped substantially, from 29% in 2020 to 17% in 2021.

The percentage increased to 23% in 2022, because of the high prices caused by the Ukraine invasion. Until the beginning of April 2023, only 15% of farmers signed future contracts due to the low prices offered by

traders, but some respondents mentioned that they intend to sign some contracts in the near future because they are worried about the future price drop.

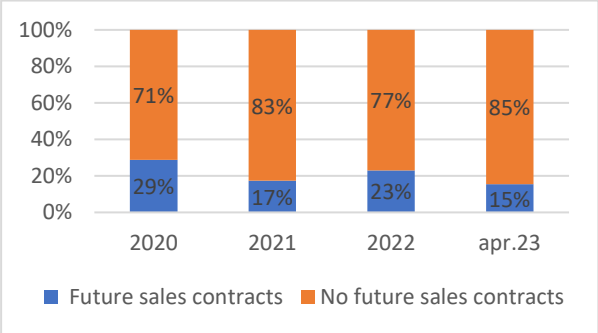


Fig. 3. Share of farmers who signed futures contracts with traders in 2020- 2023 period.
Source: Own processing.

In addition to the crops yield reduction caused by the drought, in 2022, farmers were also affected by the massive increase in fertilizers price. The prices boom started at the beginning of 2022, more exactly since the end of February. The fertilizers prices tripled, and in some cases even quadrupled during the summer [9, 12]. During that period of stock market speculation, the ratio between the price of fertilizers and the price of grains experienced the biggest difference in the last 14 years. A larger detachment took place only during the 2008 global financial crisis [6, 30].
Farmers who managed to sign the fertilizers purchase contracts before February 2022 benefited from lower inputs prices so their spring campaign expenses were shrunken compared to those who bought the fertilizers after the hostilities in the region had begun.
The chaotic evolution of prices on commodity exchanges in the last year disturbed the farmers' business strategy. In 2022, the wheat prices decline began with the start of the harvest campaign in June, dropping from over € 400/ton at the beginning of the month, to € 350/ton at the end of the month. Afterwards between July and November the price of wheat fluctuated between €315/ton and € 350/ton. Starting with December 2022, the wheat price declined constantly, reaching in April 2023 at approximately €250/ton. Maize price had a relatively similar trajectory with wheat, but with greater price fluctuations.

Regarding oilseeds, after their price exceeded €800/ton in the period March-May 2022, with maxima around €1,000/t in mid-April, starting with June 2022, it constantly decreased, reaching around €450/ton in April 2023.
This price level is much lower than the early 2022 spring, and even lower than in the 2021 spring, when the economy was starting to recover after the lockdowns caused by the COVID-19 pandemic. The prices volatility determines farmers to be reluctant in signing future contracts with the grain traders and input distributors. Apart from the global socio-economic context, there is another particular problem that affects Romanian grain growers and also the ones from Bulgaria and Poland. The owners of crop farms in Romania are extremely upset because of the influx of grains of lower quality and at a lower price from Ukraine that has affected domestic grains demand and is causing congestion in the Constanța port. The international grain trading companies are more interested in transferring an important amount of imported grains through the port of Constanta [12, 23]. As can be seen in Figure 4, the overwhelming majority of 84.6% of Romanian farmers declare themselves disadvantaged by the influx of grains.

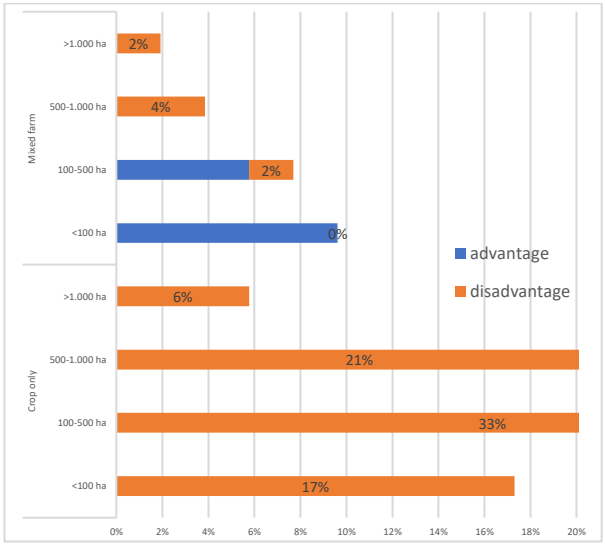


Fig. 4. Romanian farmers opinion regarding the influx of grains from abroad
Source: Own processing.

However, 15.4% of farmers, in this case those who own farms focused on animal husbandry

and cultivate areas of land smaller than 100 hectares, declared that the grain price drop had a positive impact on their livestock raising side of the business. With one exception, almost all respondents from the category of mixed farms working on areas larger than 100 hectares answered that they consider themselves disadvantaged by the influx of grains. The most affected farmers are those who stored their grains in the hope of selling them at better prices in the spring.

This old strategy is well known, used all over the world because it has given very good economic results since the beginning of modern agriculture [24, 27]. It should be noted that in 2020 and 2021, the farmers who stored their production and sold it in winter or spring obtained much higher prices and implicitly managed through this strategy to mitigate both the negative impact caused by the drought that reduced their productions and the production costs surge caused by the increase in the prices of fertilizers and other categories of inputs. As can be seen from Figure 5, the largest share of the production made by the surveyed farmers in 2022 was sold in summer, respectively 47% at harvest and 34% in autumn. The difference of 19% was stored for a longer period, and of this merchandise, 6% was sold in the winter, 7% was sold in early spring, until the beginning of April, and 6% is still in the farmers' silos.

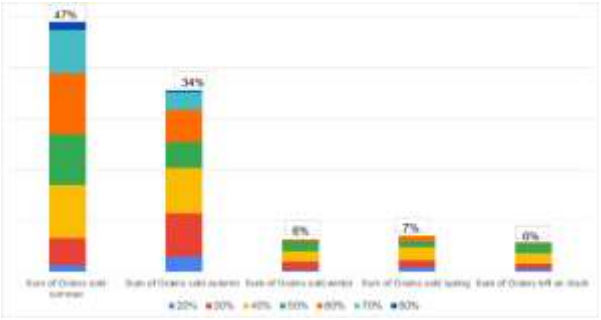


Fig. 5. Production selling timing and the traded volumes share from the total production in 2022
Source: Own processing.

Table 1. Farm structure depending on size categories, type of activity, storage capacities and share of owned land areas

| Farm structure/ Storage capacity | <10% | 10-20 % | 20-30% | 30-50% | 50-70% | <70% | Grand Total |
|---|---|---|---|---|---|---|---|
| <100 ha | 6% | 10% | 4% | 4% | 2% | 2% | 27% |
| Crop only | 6% | 10% | 2% | 0% | 0% | 0% | 17% |
| 0 t | 6% | 0% | 0% | 0% | 0% | 0% | 6% |
| <100 t | 0% | 10% | 2% | 0% | 0% | 0% | 12% |
| Mixed farm | 0% | 0% | 2% | 4% | 2% | 2% | 10% |
| 100-500 t | 0% | 0% | 2% | 4% | 0% | 0% | 6% |
| 500-1,000 t | 0% | 0% | 0% | 0% | 2% | 2% | 4% |
| 100-500 ha | 13% | 15% | 2% | 8% | 2% | 0% | 40% |
| Crop only | 13% | 12% | 0% | 6% | 2% | 0% | 33% |
| 100-500 t | 13% | 2% | 0% | 0% | 0% | 0% | 15% |
| 500-1,000 t | 0% | 10% | 0% | 4% | 0% | 0% | 13% |
| 1,000-2,000 t | 0% | 0% | 0% | 2% | 2% | 0% | 4% |
| Mixed farm | 0% | 4% | 2% | 2% | 0% | 0% | 8% |
| 100-500 t | 0% | 4% | 0% | 0% | 0% | 0% | 4% |
| 500-1,000 t | 0% | 0% | 2% | 2% | 0% | 0% | 4% |
| 500-1,000 ha | 10% | 13% | 0% | 2% | 0% | 0% | 25% |
| Crop only | 10% | 12% | 0% | 0% | 0% | 0% | 21% |
| 100-500 t | 8% | 0% | 0% | 0% | 0% | 0% | 8% |
| 500-1,000 t | 2% | 12% | 0% | 0% | 0% | 0% | 13% |
| Mixed farm | 0% | 2% | 0% | 2% | 0% | 0% | 4% |
| 1,000-2,000 t | 0% | 2% | 0% | 2% | 0% | 0% | 4% |
| >1,000 ha | 6% | 2% | 0% | 0% | 0% | 0% | 8% |
| Crop only | 6% | 0% | 0% | 0% | 0% | 0% | 6% |
| 1,000-2,000 t | 4% | 0% | 0% | 0% | 0% | 0% | 4% |
| 2,000-5,000 t | 2% | 0% | 0% | 0% | 0% | 0% | 2% |
| Mixed farm | 0% | 2% | 0% | 0% | 0% | 0% | 2% |
| 2,000-5,000 t | 0% | 2% | 0% | 0% | 0% | 0% | 2% |
| Grand Total | 35% | 40% | 6% | 13% | 4% | 2% | 100% |

Source: Own processing.

Table 1 presents the analysed farms structure according to a series of criteria related to the company's capitalization degree.

Depending on the cultivated area, the surveyed farms were divided into four size categories, according to which we have the following percentages: <100ha -27%; 100-500ha -40%; 500-1,000ha -25%; >1,000ha-8%.

In recent years, most Romanian farmers have tried to purchase a share of the land they work on lease and have invested in grain storage facilities [25].

From the perspective of the land areas owned, it can be seen that 35% of the surveyed farms own less than 10% of the land, 40% of the farms own 10-20% of the cultivated land, 6% own 20-30% of the land, 13% own 30-50% of the land and only 6% of the surveyed farms own more than 50% of the cultivated surface.

It can be observed that in most cases small and medium-sized farms, from the category up to 500ha with mixed activity, own a larger share of the cultivated land.

The share of the land owned in property is very important for farmers because it guarantees farmers the stability necessary to invest more in modern machinery, storage facilities and irrigation systems.

As can be seen in Table 1, with the exception of a few small farms of less than 100 ha that deal only with growing plants and do not have storage spaces, 94% of the analysed farms have storage facilities in halls or silos or declared that if necessary they used and will use the option of cereals temporary storage in silo-bags.

The grain storage capacity is very important, especially for the owners of mixed farms who represent 23% of the respondents and constantly need animal feed, but also for the crop farms that store their grains to get a better price.

The following paragraphs present the situation of wheat and maize crops, which have the largest share of the cultivated area in the analysed farms.

Figure 6 shows the wheat yields obtained in 2022, and the expected share that is intended to be sold through futures contracts in the summer of 2023.

Also, the graph bars are divided according to the percentage of land surfaces that can be irrigated in each farm.

The following wheat yields were obtained in 2022: 29% of the analyzed farms fell into the 6-7 t/ha category; 23% in the 5-6 t/ha category; 17% in the 4-5 t/ha category; 10% in the 7-8 t/ha category; 13% in the 3-4 t/ha category; 6% in the 2-3 t/h category, only 2% obtained over 8 t/ha.

It can also be observed that higher productions were obtained in farms that have irrigation systems.

This fact is not necessarily due to the use of the irrigation system for wheat cultivation. Most farmers use the irrigation system mainly for the maize crop.

Regarding the maize yields obtained by farmers in 2022 (Fig. 7), it should be mentioned that, due to the drought problems recorded in previous years, 8% of the surveyed farms did not cultivate corn in 2022.

In the case of the farms that cultivated corn:13% of them obtained corn productions of less than 2t/ha; 10% were in the 2-3 t/ha category; 13% in the 3-4 t/ha category; 27% in the 4-5 t/ha category; 13% in the 5-6 t/ha category; 15% in the 6-7 t/ha category; 6% in the 7-8 t/ha category and only 4% of farms obtained over 8 t/ha. In most cases, higher yields were obtained only in farms that have irrigation systems.

The results clearly show that maize crop was the most affected one by the 2022 drought.

Regarding the drought problem, in Table 2, the structure of the surveyed farms is presented according to their size, the number of employees and their irrigation infrastructure.

It can be seen that 62% of the surveyed farms do not have any kind of irrigation infrastructure and are extremely vulnerable to climate change.

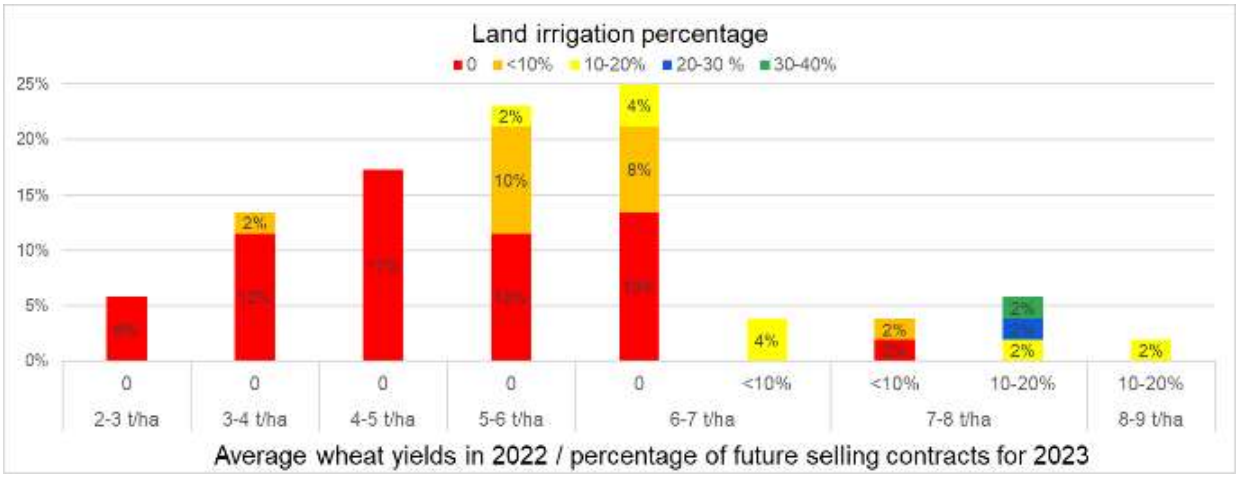


Fig. 6. Average wheat crop yields in 2022 and the production share intended for futures contracts in 2023
Source: Own processing.

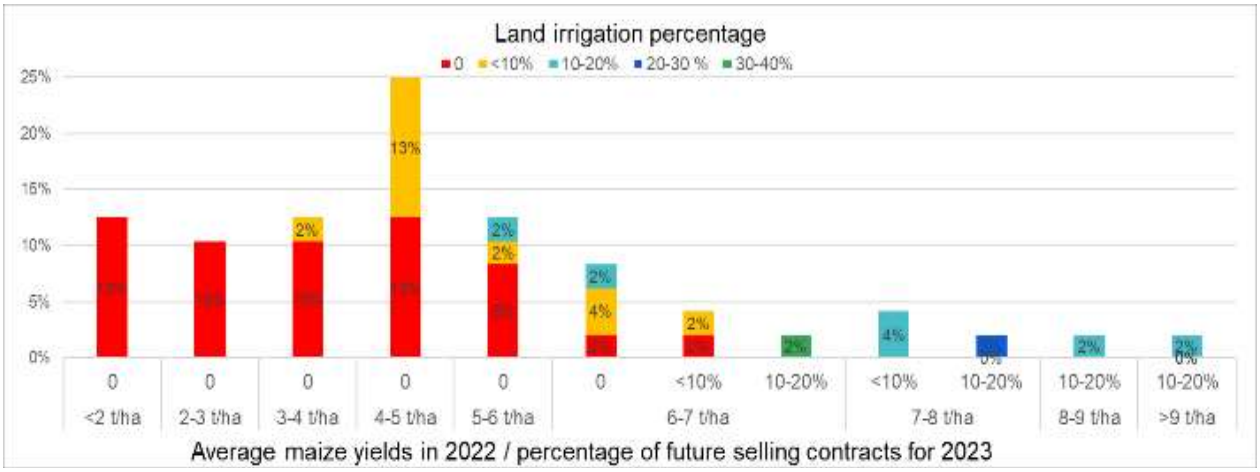


Fig. 7. Average maize crop yields in 2022 and the production share intended for futures contracts in 2023
Source: Own processing.

Among the farms that have irrigation systems: 55% can irrigate less than 10% of the cultivated surface, 35% can irrigate between 10 and 20% of the cultivated surfaces and only 10% of the farms have irrigation systems that cover more than 20% of cultivated areas.

Considering the fact that most farmers use irrigation systems such as traveling sprinkler type that are moved successively to the plots that have nearby water sources, the number of employees in these farms is higher compared to farms where irrigation is not used.

The use of irrigation systems requires a significant amount of labour needed for their transport, installation, operation and maintenance [21].

The mixed farms are more advantaged in this regard because they have a larger number of employees that can be used for the operation and guarding of the irrigation systems [1].

Although this aspect is important for farmers' budgets, the biggest problem reported by farmers is related to the absence or inoperability of irrigation canals and the bureaucracy that slows down and sometimes even blocks deep bore well drilling.

However, more than half of the farmers who irrigate have introduced irrigation systems in their farms in the last three years and declare that they want to expand the areas.

Also, approximately 26% of the respondents who do not irrigate at the moment, stated that they have started investments and hope that in the next two years they will be able to irrigate some of their crops.

The following paragraphs presents the situation of rapeseed and sunflower. These two oleaginous crops have an important proportion in the analysed farmers' crop rotation.

It should be mentioned that the areas cultivated with these crops have increased in recent years, both due to high selling prices and due to better outcome in drought years

Table 2. Farms structure depending to their size, activity profile, number of employees and the irrigated land percentage

| **Farm structure by size/ by type/ by employees number** | **0%** | **10%** | **10-20%** | **20-30%** | **30-40%** | **Total** |
|---|---|---|---|---|---|---|
| <100 ha | 19% | 4% | 2% | 0% | 2% | 27% |
| Crop only | 17% | 0% | 0% | 0% | 0% | 17% |
| 1 | 10% | 0% | 0% | 0% | 0% | 10% |
| 2 | 8% | 0% | 0% | 0% | 0% | 8% |
| Mixed farm | 2% | 4% | 2% | 0% | 2% | 10% |
| 2 | 2% | 4% | 2% | 0% | 0% | 8% |
| 3 | 0% | 0% | 0% | 0% | 2% | 2% |
| 100-500 ha | 23% | 10% | 8% | 0% | 0% | 40% |
| Crop only | 19% | 8% | 6% | 0% | 0% | 33% |
| 2 | 10% | 0% | 0% | 0% | 0% | 10% |
| 3 | 10% | 8% | 0% | 0% | 0% | 17% |
| 4 | 0% | 0% | 4% | 0% | 0% | 4% |
| 5 | 0% | 0% | 2% | 0% | 0% | 2% |
| Mixed farm | 4% | 2% | 2% | 0% | 0% | 8% |
| 5 | 2% | 0% | 0% | 0% | 0% | 2% |
| 8 | 0% | 2% | 0% | 0% | 0% | 2% |
| 9 | 0% | 0% | 2% | 0% | 0% | 2% |
| 6 | 2% | 0% | 0% | 0% | 0% | 2% |
| 500-1,000 ha | 17% | 6% | 2% | 0% | 0% | 25% |
| Crop only | 17% | 4% | 0% | 0% | 0% | 21% |
| 2 | 2% | 0% | 0% | 0% | 0% | 2% |
| 3 | 6% | 0% | 0% | 0% | 0% | 6% |
| 4 | 6% | 0% | 0% | 0% | 0% | 6% |
| 5 | 2% | 2% | 0% | 0% | 0% | 4% |
| 7 | 0% | 2% | 0% | 0% | 0% | 2% |
| 6 | 2% | 0% | 0% | 0% | 0% | 2% |
| Mixed farm | 0% | 2% | 2% | 0% | 0% | 4% |
| 14 | 0% | 0% | 2% | 0% | 0% | 2% |
| 11 | 0% | 2% | 0% | 0% | 0% | 2% |
| >1.000 ha | 2% | 2% | 2% | 2% | 0% | 8% |
| Crop only | 2% | 2% | 2% | 0% | 0% | 6% |
| 9 | 2% | 0% | 0% | 0% | 0% | 2% |
| 10 | 0% | 2% | 0% | 0% | 0% | 2% |
| 13 | 0% | 0% | 2% | 0% | 0% | 2% |
| Mixed farm | 0% | 0% | 0% | 2% | 0% | 2% |
| 27 | 0% | 0% | 0% | 2% | 0% | 2% |
| Total | 62% | 21% | 13% | 2% | 2% | 100% |
| | | | | | | |

Source: Own processing.

Rapeseed is an autumn crop that reaches maturity in early summer, avoiding high summer temperatures. Also, sunflower crop is more resistant to drought compared to maize crop.

In the case of the rape crop presented in Fig. 8, the results show that 29% of the surveyed farms did not harvest rapeseed in 2022. This phenomenon is found especially in smaller farms that avoid introducing this oleaginous plant in their crop rotation due to the higher complexity of the cultivation technology, which implies higher costs compared to other crops.

It should be mentioned that among the 29% who did not harvest rapeseed last year, approximately 18% sowed rapeseed in the fall of 2021 but replaced the crop in the spring of 2022 due to problems caused by the drought.

From the perspective of rape seed production, 46% of the farms fell into the 2-3 t/ha category; 38% fell into the 3-4 t/ha category; 5% obtained more than 4 t/ha and 11% obtained only 1-2 t/ha.

The results of sunflower cultivation presented in the above figure reveal average productions that fell into the following categories: 3-4 t/ha for 34% of the farms; 2-3 t/ha for 38% of farms; 1-2 t/ha for 22% of farms; less than 1 t/ha in 4% of cases; more than 4 t/ha in 2% of cases. In 4% of the surveyed farms, sunflower wasn't cultivated in 2022.

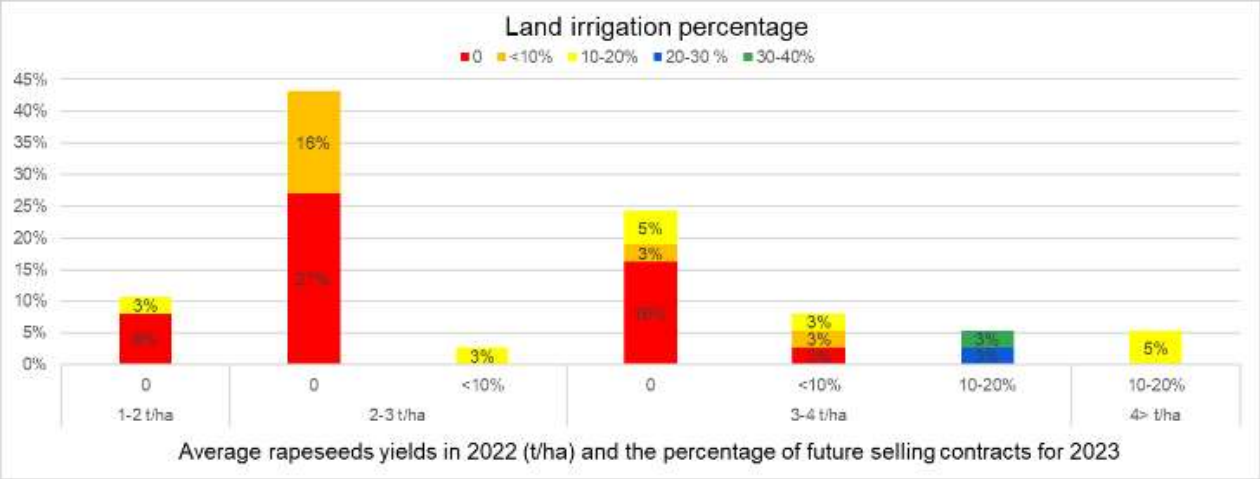


Fig. 8. Average rapeseed crop yields in 2022 and the production share intended for futures contracts in 2023
Source: Own processing.

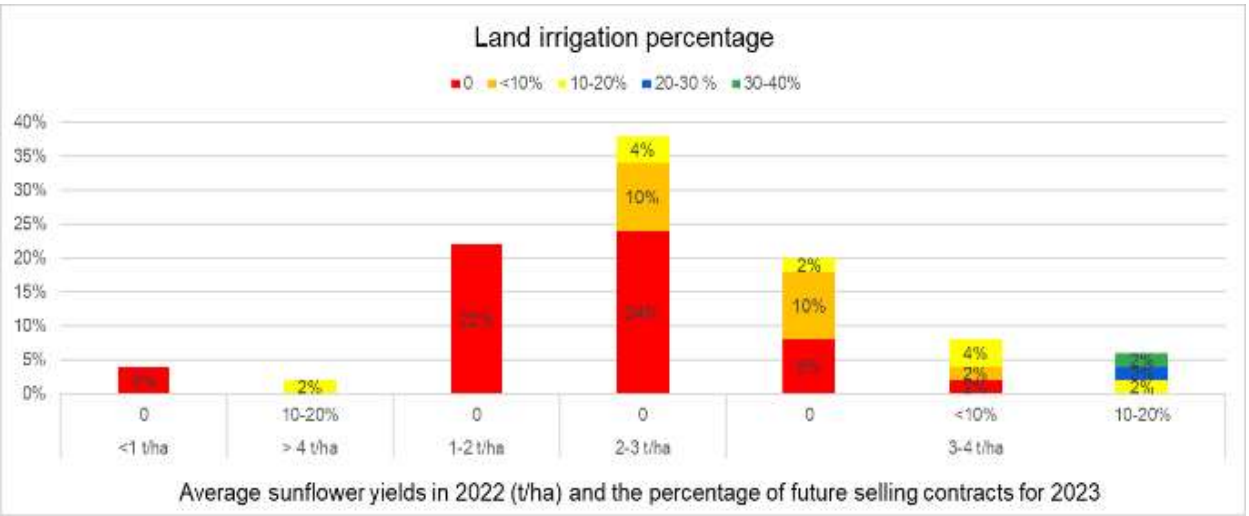


Fig. 9. Average sunflower crop yields in 2022 and the production share intended for futures contracts in 2023
Source: Own processing.

As it can be seen from the analysed crops graphs and Figure 3 and Table 3, until the beginning of April, only 15% of farmers signed future sale contracts with traders. The analysis shows that mostly, only those who obtained above average yields in 2022 and use irrigation systems signed futures contracts for a percentage of the harvest in the summer of 2023. In this way they protect themselves against economic uncertainties, securing the selling price for approximately 5-20% of the expected production. Table 3 presents the analysis of farmers trading behaviour according to their farms size and their education level. As can be seen in Table 3, 48% of the respondents analysed in this study have completed higher education, 21% are students and 31% have secondary education.

Depending on the size categories, it can be observed that, with the exception of the categories below 500 ha, in the case of larger farms, most farmers have higher education. Even in the 100-500 ha category, almost half of the respondents have higher education. In the size category over 1,000 ha, all respondents have higher education.

Table 3. Farmers trading behaviour according to farm size, signed future contracts, grains left on stock and farmers education level

| Farm size/ future contracted % of 2023 expected yields/ remaining stocks in April 2023 | | Higher education | Secondary education | Students | Total |
|---|---|---|---|---|---|
| <100 ha | Stocks | 6% | 12% | 10% | 27% |
| 0% | | 6% | 12% | 10% | 27% |
| | 0% | 4% | 10% | 10% | 23% |
| | 10% | 0% | 2% | 0% | 2% |
| | 20% | 2% | 0% | 0% | 2% |
| 100-500 ha | | 19% | 12% | 10% | 40% |
| 0% | | 13% | 12% | 10% | 35% |
| | 0% | 4% | 10% | 6% | 19% |
| | 10% | 2% | 2% | 4% | 8% |
| | 20% | 6% | 0% | 0% | 6% |
| | 30% | 2% | 0% | 0% | 2% |
| <10% | | 4% | 0% | 0% | 4% |
| | 0% | 2% | 0% | 0% | 2% |
| | 20% | 2% | 0% | 0% | 2% |
| 10-20% | | 2% | 0% | 0% | 2% |
| | 0% | 2% | 0% | 0% | 2% |
| 500-1,000 ha | | 15% | 8% | 2% | 25% |
| 0% | | 10% | 8% | 2% | 19% |
| | 0% | 4% | 4% | 2% | 10% |
| | 10% | 2% | 2% | 0% | 4% |
| | 20% | 4% | 2% | 0% | 6% |
| <10% | | 6% | 0% | 0% | 6% |
| | 0% | 4% | 0% | 0% | 4% |
| | 10% | 2% | 0% | 0% | 2% |
| >1,000 ha | | 8% | 0% | 0% | 8% |
| 0% | | 4% | 0% | 0% | 4% |
| | 10% | 4% | 0% | 0% | 4% |
| 10-20% | | 4% | 0% | 0% | 4% |
| | 0% | 4% | 0% | 0% | 4% |
| Total | | 48% | 31% | 21% | 100% |

Source: Own processing.

It can be observed that all respondents who signed future contracts with traders have higher education. From the perspective of the grain storage decision, it can be observed that the majority of farmers who still have grains in stock have higher education and most of them own farms between 100 ha and 500 ha. Around 94% of the farmers who still have grains in stock have not signed contracts with traders until now and the 6% who have signed contracts have secured the price for less than 10% of the 2023 expected yields. Only 6% of the surveyed farmers have signed contracts for quantities between 10% and 20% of the expected production.

At the beginning of April 2023, 36% of the surveyed farmers still have a part of the 2022 production in stock. Half of them still have about 10% of the production stored and the other half have 20%.

Approximately half of the 36% of farmers who still have grains in stock at this moment declared that in previous years they stored smaller quantities or even did not store grains. After observing the substantial gains obtained by other farmers in the springs of 2020 and 2021, some of them started the construction of storage halls or paid specialized companies to help them store grain in silo-bags. To their disappointment, now they find themselves in the situation of selling the cereals at prices lower by up to 50% compared to the 2022 summer prices and also having to bear the storage costs.

Considering the fact that the 2022 drought decreased their yields and the fertilizers

prices, their grains production cost is high and the expenses continue to increase with each week of grain storage. The trading strategy that gave very good economic results in 2021 and 2022, turned out to be quite damaging for their business in the spring of 2023.

Another business strategy that gave very good results in the spring 2020-spring 2022 period was the early purchase of inputs, especially fertilizers because their prices tripled during that period.

Despite the fertilizer prices decline on commodity exchanges, starting from the second half of 2022, Romanian input distributors pursued a speculative selling strategy, trying to get farmers to sign fertilizer purchase contracts as soon as possible. Some respondents stated that although the prices were high, they signed the purchase contracts earlier because the distributors suggested them that there would have been numerous bureaucratic problems and logistical blockages in the fertilizers import process which would have led to problems with the availability of fertilizers in the autumn and spring agricultural campaigns.

As can be seen in Figure 10, in the agricultural year 2022/2023, the strategy of early signing purchase contracts for fertilizers has proven to be detrimental to some farming business.

From the analysis of fertilizer purchasing behavior, it can be seen that 44% of the total volumes purchased by farmers for the autumn agricultural campaign were contracted in August; 29% in September; 13% in July, 8% in October; 4% in June and 2% in November.


Fig.10. Fertilizer prices evolution in the period June 2022-April 2023 and the farmers purchase timing behaviour
Source: Questionnaire responses and Eurostat [5].

A proportion of farmers who bought some fertilizers in June and July, stated that they hurried because they were worried about a possible price increase. Also, some of the farmers who purchased large volumes of fertilizers in August declared that normally they would have purchased some of those fertilizers in September, but they were influenced by the pessimistic explanations given by the distributors.

In case of the spring agricultural campaign, the volumes of fertilizers started with 2% in December, continued with 9% in January 2023; 26% in February, the highest share - 48% in March and only 15% in April. It should be mentioned that the farmers' answers regarding the month of April 2023 are only from the first week. Also, the purchasing behaviour of the farmer was influenced primarily by the offers received from the distributors, price reductions depending on the purchased volumes, payment terms and credit facilities. Most of the farmers declared that they postponed as much as they could the purchase of fertilizers in order to benefit from themarket falling prices. Just as in the autumn

campaign case, some farmers who made purchases in the months of January-February are no longer satisfied with their decision.

## CONCLUSIONS

According to the literature review and from the survey and the face-to-face interviews conducted with Romanian farmers, the following conclusions and farmers concerns can be drawn.

In addition to the problems caused by the droughts of 2020 and 2022, which will certainly repeat in the following years due to climate change, the high volatility of commodities market in the last three years caught many farmers off-guard and had seriously affected their businesses financial stability.

The global economic instability caused by COVID-19 pandemic, rising inflation, the conflict in the proximity and the tensions caused by territorial disputes in other parts of the globe, set signs of a global recession that have led to the commodity market decline in the spring of 2023 [23].

In this uncertain economic climate, Romanian farmers will have to plan their business strategy extremely carefully in the coming years.

Many market forecasts anticipate a grains price and also a low demand for domestic grains and the congestions in the Constanța port to continue.

According to an optimistic scenario, it is expected as it will take several more years until the natural gas market will stabilize at cost effective values for fertilizers synthesis in European factories.

The interviewed farmers' showed concerns inclined to a pessimistic scenario in which their grains production costs will continue to stay high due to the increased fertilizers prices, and the grains prices on commodities exchanges will be reduced. In this scenario, farmers' potential profit margin will remain small in the coming years.

Many farmers tended to trade impulsively and to adjust their strategy based mostly on the last years experiences.

In 2020 and 2021, the business strategy in which the farmers bought fertilizers early and stored and sold the grains in late spring substantially increased the profit margin of those who did that. Observing this aspect, even more farmers adopted this trading behavior in 2022. Unfortunately for them, the evolution of commodity markets in the agricultural year 2022/2023 was diametrically opposed to previous years. Starting with the summer of 2022, both the price of fertilizers and the price of grains have dropped considerably, and farmers who purchased fertilizers sooner and sold the grains later have substantially reduced their profit margin. Some of them even lost money because they bought fertilizers at high prices, the drought reduced crops yields consequently increasing the production costs and, in this spring, they ended up having to sell some of their grains at prices that did not cover production costs.

The commodities trading behaviour that gave very good economic results in 2021 and 2022, turned out to be quite damaging for crop farming business in the spring of 2023.

Because of this precarious economic context, some respondents declared that they no longer know what business strategy to follow in the coming years.

Only few farmers fully understood the speculative nature of commodity markets and managed to obtain consistent profits in the last three years by constantly changing and adapting their business strategyand effectively using risk hedging instruments such as crop insurance, future contracts and split grains sales and inputs purchases.

In conclusion, the only long-term sustainable solution to reduce the crop farmers dependence on traders' exports and to lower the commodities exchanges price volatility risks consists in the development of the animal husbandry sector, the increase of processing capacities of domestic agricultural products and the development of irrigation infrastructure.

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# THE VARIABILITY AND INFLUENCE OF PRECIPITATION ON THE WINTER WHEAT IN THE EXTRA-CARPATHIAN AREA OF THE MERIDIONAL AND CURVATURE CARPATHIANS (ROMANIA)

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***Abstract***

*The annual variability of the climatic factors is reflected in the variability of the agricultural yields from one year to another and the analysis of the impact of climate variability on agricultural crops can facilitate the adoption of measures to prevent, mitigate or combat the damage it causes to agriculture. The main objective of this study is to analyze the precipitation regime for the Extra-Carpathian area of the Meridional and Curvature Carpathians, in relation to the optimal water precipitation requirement of the winter wheat. The analysis of precipitation variability will be based on the monthly precipitation amounts from 19 meteorological stations (M.S.) belonging to the National Meteorological Administration, for the period 1991 – 2020. The methods used are logical, spatial and comparative analyses of the climate and production data, literature research and GIS techniques. The annual precipitation amounts, for the analyzed period, have recorded values ranging from 727.7 mm atRâmnicu Vâlcea M.S. to 240.5 mm at Sulina M.S.As it concerns the winter wheat crop productivity, the values of the yields varied from 1,429kg/ha to 4,888 kg/ha in the study area. The conditions closer to or further away from optimum requirements and thus, a variability of harvests from a year to another are provided by the great variability of precipitation along with other climatic factors which influence the growth and development of winter wheat. As a result, the precipitation regime is a determining factor for the entire plant physiology.*

***Key words*:** *precipitation, climate variability, winter wheat, yields,Extra-Carpathian area*

## INTRODUCTION

The winter wheat, like any cultivated plant, has certain bioclimatic requirements, which influence the vegetative processes and crop productivity. These bioclimatic requirements are in relation to the main climatic factors: light, temperature and precipitation [13]. The annual fluctuation of the climatic factors determines the variability of yields from one year to another [11]. The analysis of the climate variability on vegetation and agricultural production is the basic criterion for adopting measures to prevent, mitigate or combat the damage it causes to agriculture. The objective of this study is to analyze the variability of the precipitation regime from 1991 to 2020 and its influence on the winter wheat crop and yields.

The common wheat is the most important species, both worldwide and in most of the cultivated area in Romania, representing 90% of the cultivated area [10]. The varieties of common wheat are the spring wheat and winter wheat cultivated on about 99% of Romania's arable land [6].

In the transitional temperate continental climate [7] characteristic of the territory of Romania, the winter wheat is cultivated as a rainfed crop [9]. The winter wheat has a vegetation period of 230 to 250 days, being mainly influenced by the pedoclimatic

conditions, but also by the cultivated variety [15].

Precipitation is the main source of water for the growth and development of the agricultural crops [5, 15]. The precipitation regime on the territory of Romania is characterized by a great variability and discontinuity in time and space [1]. In the context of the present global warming, the ability to objectively evaluate the water resources required for an agricultural crop are offered by the analysis of the precipitation regime.

The study area where is analyzed thevariability and influence of precipitation on winter wheatis the Extra-Carpathian area of the Meridional and Curvature Carpathians. It corresponds to very favorable and favorable areas for the cultivation of winter wheat [14] especially represented by the Romanian Plain, the Getic Plateau and the Dobrogea Plateau (Fig. 1). From administrative point of view, the study area overlaps most of the Economic Development Regions: the South-West Oltenia, the South Muntenia, Bucharest-Ilfov and the South-East.

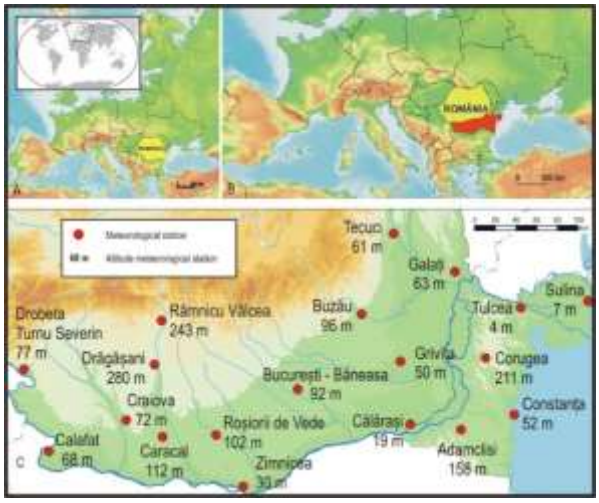


Fig. 1. The location of the study area and of the meteorological stations.
Source: own processing from GIS open sources.

## MATERIALS AND METHODS

The analysis of the precipitation variability was carried out on the basis of the precipitation data from 19 meteorological stations (MS) belonging to the National Meteorological Administration (NMA). These stations, with altitudes between 7 m a.s.l. and 280 m a.s.l., are considered representative for the study area (Fig. 1).The precipitation parameters used in the analysis are: the monthly average amounts and the annual amounts. The analysis was completed with the calculation of the standardized anomaly for the annual precipitation [8]. The formula used was: $x_{anomaly} = \frac{x-\mu}{\sigma}$ , where$x_{anomaly}$is the standard anomaly; $x$ isthe annual value; $\mu$ is the annual average value for the period 1991 – 2020 and $\sigma$is the standard deviation for the period 1991 – 2020.In order to capture the influence of the monthly and annual precipitation on the winter wheat yields, the average production data per hectare (ha) from the National Institute of Statistics (NIS) were analyzed for the period 1991 – 2020. The space-time analysis of precipitation was carried out using the statistical methods and GIS techniques.

## RESULTS AND DISCUSSIONS

The water resources offered by Romania's climate are favorable in general, from the point of view of the values of the annual precipitation amounts, throughout the growing season of the winter wheat and in most of the country [13].For large productions, the water requirements, depending on the climate and duration of vegetation, are between 450 and 650 mm [9]. In Romania, according to the latest experimental research, the amount of approximately 600 mm of precipitation is considered optimal for the entire vegetation period [15]. The precipitation requirements of the winter wheat, over the entire growing season are moderate, but must be balanced as a monthly distribution. The minimum amount of precipitation required is 225 mm [114]. The annual average amount of precipitation, at the level of the entire study area, for the analyzed period is 567.4 mm, being very close to the optimal precipitation requirement for the entire vegetation period. The precipitation regime is characterized by a large space and time variability of the monthly precipitation amounts and also of the annual precipitation amounts. The precipitation may act, in some

areas, both monthly and annually, as a risk factor and may become a limiting factor.

As a rule, for the analyzed period, in the annual regime of the monthly precipitation, the lowest monthly average amount of precipitation has been recorded in February, while the highest one has been recorded in June (Fig. 2).

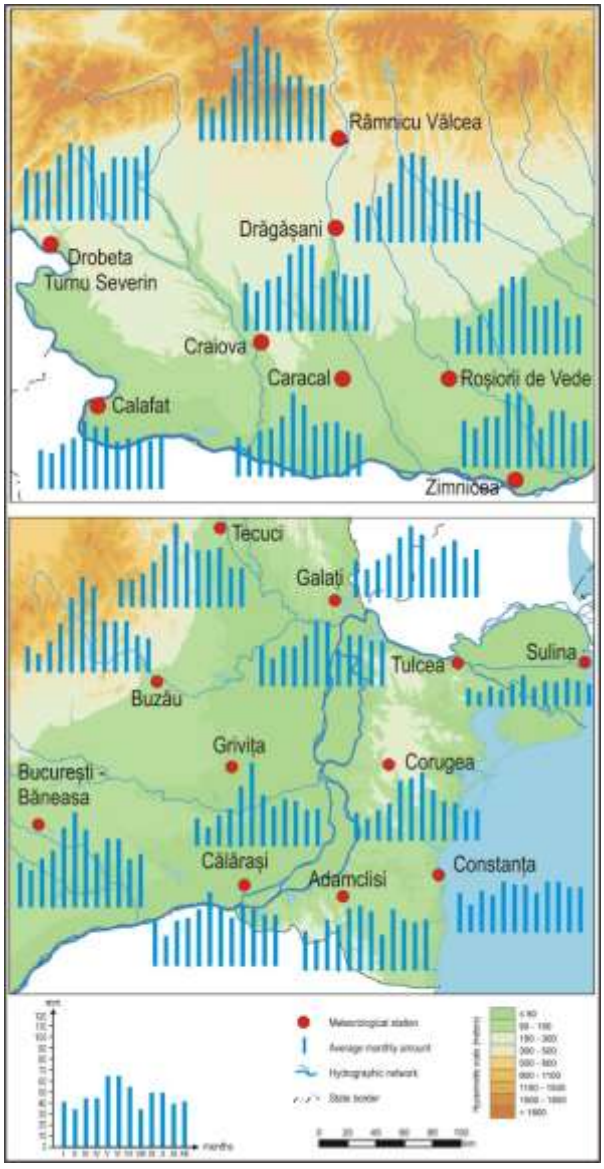


Fig. 2.The annual regime of the monthly average precipitation amounts (mm) at the meteorological stations analyzed for the period 1991 – 2020.
Source: own processing from GIS open sources.

The critical period with respect to precipitation of winter wheat is the interval May – June. During the vegetation months, the optimal precipitation requirement is rendered in Table 1[15]. The analysis of the distribution in space of the monthly precipitation amounts highlights the pluviometric potential of the analyzed region.

Table 1. The reference thresholds for the optimal precipitation requirement (mm) of the winter wheat. Note: light blue – critical period.

| Culture | Month | Precipitation (mm) |
|---|---|---|
| winter wheat | IX | 40.0 |
| | X | 60.0 |
| | XI – III | 200.0 |
| | IV | 50.0 |
| | V | 80.0 |
| | VI | 80.0 |
| | VII | 50.0 |
| | VIII | 40.0 |
| | IX – VIII | 600.0 |

Source: [15].

In relation to the reference thresholds of the optimal monthly precipitation values required for winter wheat, it is found the next, from Figure 2 and Table 1:

* The values of the lowest monthly average amount oscillate between 11.9 mm at Sulina MS and 42.7 mm at DrobetaTurnu (Dr. Tr.) Severin MS recorded in February.
* The values of the highest average monthly amount vary between 28.3 mm at Sulina MS and 100.7 mm at Râmnicu (Rm.) Vâlcea recorded in June. These precipitations are mostly in the form of showers and their quantitative distribution is uneven [1].
* From the point of view of the critical period for the winter wheat, for the analyzed period, the optimal precipitation requirement of 80 mm for the months of May and June was recorded in proportion 5.3% for May and 15.8% for June. At most meteorological stations, there is a precipitation deficit compared to the optimal requirement of 15 – 20 mm for May and 10 – 15 mm for June.
* The values of the annual precipitation amounts, for the period 1991 – 2020, vary between 240.5 mm at Sulina MS and 727.7 mm at Rm. Vâlcea MS.
* The Sulina meteorological station records the lowest precipitation values for both monthly and annual amounts. However, for the entire vegetation period of winter wheat, the annual precipitation amount is greater than the minimum required amount by 15.5 mm.

The increase of the continentalism degree determines, in the study area, a significant decrease in the precipitation amount from the West to the East[8]. Furthermore, the precipitation amount increases with 100 m by altitude in the temperate regions [4]. It has been noticed that only in the Eastern part of the study area, the degree of coverage of the optimal precipitation requirements satisfactory, while in the Eastern extremity of the Dobrogea Plateau, the degree of coverage of the optimal precipitation requirement is unsatisfactory (Fig. 2).

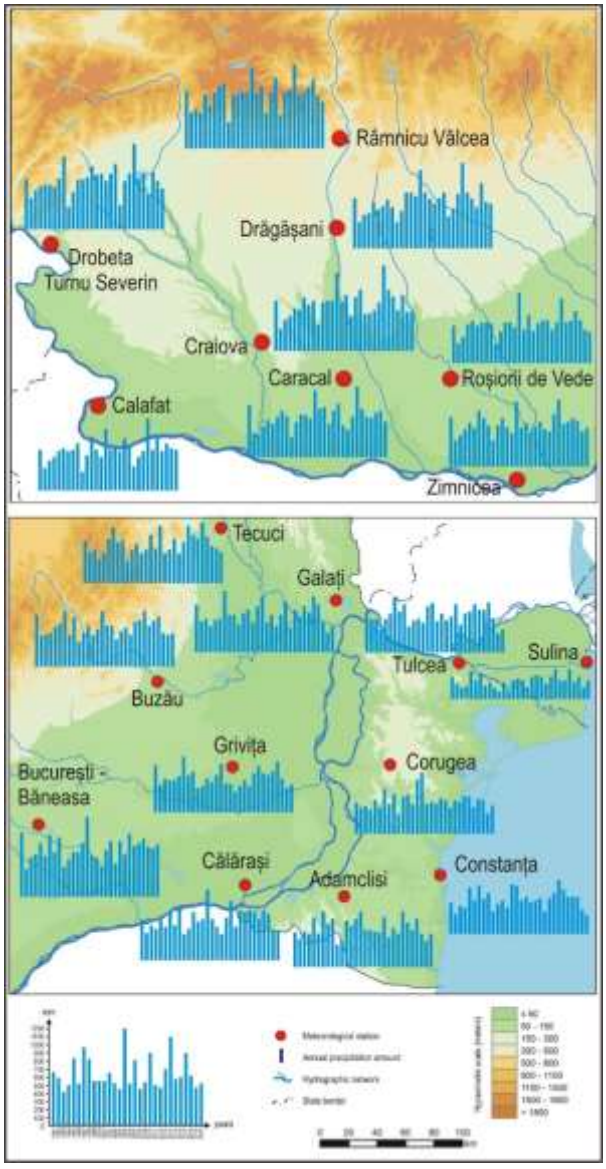


Fig. 3. The annual precipitation amount variation (mm) from one year to another, at the analyzed meteorological stations for the period 1991 – 2020.
Source: own processing from GIS open sources.

The annual precipitation amount varies from one year to another, resulting either from the internal processes of the climate system or from natural or anthropogenic variations of external forces [3].

Figure 3 shows that there is an annual fluctuation of the precipitation amounts in the study area for the period 1991 – 2020.

It has been noticed that the annual precipitation amount varies in the years with liquid precipitation excess or with a drought phenomenon. In the study area, it is stand out:

* Years with excess precipitation: 1997, 1999, 2004, 2005, 2007, 2010, 2014, 2016, 2017. Among them, the most representative are the years 2005 and 2014, which are predominant at most of the meteorological stations analyzed (Fig. 3). For example, at Rm. Vâlcea MS, both in 2005 and in 2014, the annual precipitation amounts over 1,000 mm were recorded. At Sulina MS, the highest annual precipitation amounts were recorded in 2016 (400.4 mm) and 2014 (390.4 mm).
* Dry years: 1992, 1993, 1994, 2000, 2003, 2008, 2011, 2019, 2020. The representative years for most of the meteorological stations analyzed are 2000, 1992 and 2008. In 2000, the annual precipitation amount was recorded at Rm. Vâlcea MS of 350.2 mm and at Sulina SM, in 2003, the amount of 109.5 mm was recorded (Fig. 3).

As a result, based on Figure 3, we can conclude that at any of the meteorological stations analyzed, the annual precipitation fluctuations are recorded, which are obviously reflected in the level of yields obtained.

This annual fluctuation in the precipitation amounts is also evident from the calculation of the standardized anomaly for the annual precipitation (Fig. 4). It is found that positive anomalies alternate with negative ones and that their frequency differs from one station to another. In the study area, at most of the meteorological stations analyzed, a higher frequency of negative anomalies is found for the first decade of the analyzed period, 1991 – 2010.

For the last decade of the analyzed period, 2011 – 2020, no particular pattern can be observed, but it is need for point-by-point analysis of each station. This aspect once again reflects the need

to evaluate the degree of agroclimatic favorability of agricultural areas in order to adopt the best preventive measures, reducing and combating effects on crops and yields.
Obtaining minimum yields of the winter wheat corresponding to the surface unit is not ensured by the annual precipitation amount, but by the distribution of the monthly amounts of precipitation during the vegetation period of the plants [2].

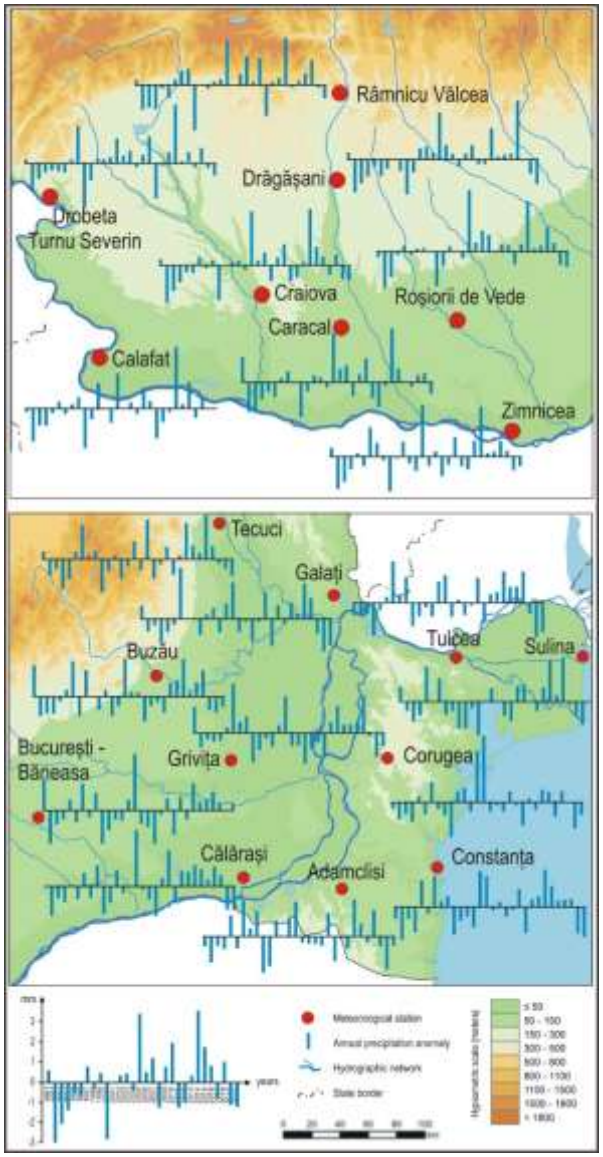


Fig. 4. The annual precipitation anomaly (mm) at the analyzed meteorological stations for the period 1991 – 2020.
Source: own processing from GIS open sources.

The variability of the precipitation influences the productivity of the winter wheat, one of Romania's strategically important crops, which presents significant annual yield fluctuations. These yields are much more affected in years when extreme climate events occur, such as drought and periods of excess precipitation. Table 2 shows the annual yields at the level of the entire study area for the period 1991 – 2020. The yields varied between 848 kg/ha in 2003, one of the dry years and 4,875.3 kg/ha in 2017, considered a year with excess precipitation (Table 2).

Table 2. The average production per hectare (kg/ha) of the winter wheat in the study area (1991 – 2020). Note: light yellow – the lowest average production per hectare; dark yellow – the highest average production per hectare.

| Culture | Year | Average of production (kg/ha) | Year | Average of production (kg/ha) |
|---|---|---|---|---|
| winter wheat | Decade 1991 – 2000 | | | |
| | 1991 | 2,524.3 | 1996 | 1,386.5 |
| | 1992 | 2,517.0 | 1997 | 3,018.5 |
| | 1993 | 2,284.0 | 1998 | 2,535.5 |
| | 1994 | 2,180.3 | 1999 | 2,960.3 |
| | 1995 | 2,976.5 | 2000 | 2,343.0 |
| | Decade 2001 – 2010 | | | |
| | 2001 | 2,994.5 | 2006 | 2,824.0 |
| | 2002 | 1,514.0 | 2007 | 1,115.8 |
| | 2003 | 848.0 | 2008 | 3,381.8 |
| | 2004 | 3,343.5 | 2009 | 2,324.3 |
| | 2005 | 2,890.8 | 2010 | 2,708.0 |
| | Decade 2011– 2020 | | | |
| | 2011 | 3,641.0 | 2016 | 3,946.0 |
| | 2012 | 2,566.0 | 2017 | 4,875.3 |
| | 2013 | 3,500.3 | 2018 | 4,746.3 |
| | 2014 | 3,616.0 | 2019 | 4,758.0 |
| | 2015 | 3,824.5 | 2020 | 2,793.8 |

Source: processed data from NIS, 2023 [12].

Because the agricultural production depends on precipitation amounts, the need for irrigation follows. A good commercial yield, under the irrigation norm of the winter wheat is 6 – 9 tons/ha [15]. In any year of the analyzed period, there was not an average production per hectare higher than 5 tons in the non-irrigated winter wheat crop.

## CONCLUSIONS

The use of the agroclimatic information in agricultural management would diminish or avoid the negative impact of the natural variability of the climate factor, but currently intensified due to the current global warming. The pluviometric resources of an area influence the level of agricultural yields year by year, depending on the duration and intensity of the disturbing factor, but

especially on the mode of action alone or associated with the thermic and light resource, to which is added the bioclimatic requirement of the plant during the period of vegetation.

The aim of this study was to analyze the singular mode of action of the precipitation on the winter wheat crop.

The main source of water for the development and growth of any agricultural crop is the precipitation. The quantitative variability andthe space-time distribution for the period 1991 – 2020 are reflected in the year-to-year fluctuation of the winter wheat yields. It was found that in the dry years, with annual precipitation amounts far below the optimal value of 600 mm, the yields are low and in years when the annual amounts were close to or greater than the optimal amount of precipitation, the yields were high. It was also found that there are years in which this optimal precipitation requirement is ensured for the entire vegetation period, but the recorded yields are lower as a result of the distribution of monthly precipitation amounts that do not ensure the optimal monthly precipitation requirements.

The analysis of the variability of the main climatic factors allows, for each agricultural area, the selection of crop plants and the establishment of the necessary measures for the development of the agricultural production process from the point of view of the cost-benefit ratio.

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# ANALYSIS OF SOCIAL ECONOMIC PROFILE OF RURAL AREA IN CĂLĂRAȘI COUNTY, ROMANIA

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***Abstract***

*Rural areas in Romania are affected by the significant lack of infrastructure and its deficiencies that have a deep impact both on the economic development and quality of life. According to the latest statistics, 42% of Romania population lives in villages. In the south of the country, 58% of the total population lives in the countryside, being the highest percentage compared to the other regions. Starting from this state of facts, in this study, we set out to make an x-ray of the social-economic profile of the rural environment in Călăraşi county by analyzing the structure and evolution of the number of agricultural companies, the cultivated area, the associative forms from the county, the labor resources employed in agriculture, but also the transport, education and health infrastructure. The analysis of the rural profile of Călăraşi county aims to formulate solutions and proposals in creating concrete conditions regarding the functionality of a socio-economic environment favorable to the consolidation of a sustainable and multifunctional development of the rural space. As research methods, we collected and descriptively analyzed statistical data, studied technical documents and specialized bibliography, and to analyze the state of the county's rural environment, we proceeded to develop a SWOT analysis. The overall analysis of the components of the rural area reveals that the prospects for the development of rural communities are affected by the economic, social and infrastructural backwardness of the rural area of Călăraşi County, but at the same time it has considerable advantages, as presented in the SWOT analysis, whose capitalization will have a significant impact on the future economic and social development of the rural area of the county.*

***Key words*****:** *analysis, rural area, poverty reduction, rural population, regional development*

## INTRODUCTION

The evolution and economic viability of rural areas are supported by the Common Agricultural Policy by financing actions to develop this economic-social space [1]. Being the second pillar of the common agricultural policy (CAP) that supports the income and market measures provided for in the first pillar, rural development aims to strengthen the concept of economic-social and environmental sustainability of rural areas [4, 5].

As a component of the CAP, the European Union's rural development policy has evolved from a policy dealing with the problems of the agricultural sector, to a multi-role policy dealing with the various challenges of the rural area. [4, 5, 7]. Thus, the primary role of rural development policies is to solve the problems faced by rural areas and to capitalize on their potential [11]. Currently the rural development policy of the E.U. reflects to a greater extent the needs of EU citizens paying special attention to the environment, food safety and quality. The concept of "rural" defines the entire space in which villages or communes are located, the interdependence relationships created between them, the resident human communities and the related geographic, demographic, ecological and socio-cultural particularities [3, 9, 10].

In Romania, the rural area includes the administrative-economic units of the "commune" type, defined in Article 5 of Law 2/1968, as follows: "the commune is the territorial administrative unit that includes the rural population united by common interests and traditions. A commune consists of one or more villages depending on the economic, social, cultural, geographical and demographic conditions. The organization of the commune ensures the economic,

administrative, cultural and social development of rural localities" [18, 13].

Among all the states of the European Union, in 2021, Romania (with 3,757 thousand) had the largest share of the rural population, followed by Poland (3,703 thousand) and Spain (3,542 thousand), according to information published in Eurostat [5, 6].

Agriculture acted as an occupational buffer against the social-economic effects of the transition, by absorbing the labor force released by urban industries, indicating a decrease in labor productivity per worker and suggesting a masked unemployment, increasing in rural areas [4, 8]. Being a sector with considerable economic potential, which traditionally occupies an important place in the Romanian economy, agriculture is, at the same time, an important factor in ensuring social stability and preserving the ecological balance, in ensuring food for the population but and the need for raw materials for the food industry and beyond. Regarding the South Muntenia Region, in which Călărași County is located, in the period 2020-2021, it ranked second, in terms of the evolution of the rural population, in first place being the North-East Region, with a weight of 56.85% of the rural population [12].

The 50 communes in the studied area present differences in terms of demographic, economic and infrastructure aspects, which makes the process of identifying all the existing problems in this area particularly difficult, and more than that, establishing the ways to solve them, from this that is why we decided to focus on their common characteristics.

In this context, I conducted the present study, the purpose of which is to highlight the social-economic profile of the rural area in Călărăsi County, by analyzing some indicators related to the evolution and structure of agricultural companies, cultivated areas, the associative forms in the county agriculture and the labor resources employed in agriculture, but also transport, educational and health infrastructure to formulate solutions and proposals that lead to the sustainable and multifunctional development of the rural area in Călărași county.

## MATERIALS AND METHODS

As research methods, we collected and descriptively analyzed statistical data, studied technical documents and specialized bibliography, and to analyze the state of the county's rural environment, we proceeded to develop a SWOT analysis.

In order to achieve the objectives of the research, to determine the indicators regarding the evolution of the rural population, the agricultural sector in the county, development of the technical-social infrastructure, we studied the following sources of information: a series of scientific publications with reference to the researched subject, data from the County Statistics Office Călărași and the County Agricultural Directorate [14, 15], from the National Institute of Statistics [12], as well as consulting the specialized literature. The data were collected, processed and interpreted in the form of descriptive, statistical and SWOT analysis, then to be transformed into conclusions and recommendations regarding the level of development of the rural area in Călăraşi county. Research tools included: analysis, synthesis, deduction, comparison method. This study covers the period 2013-2021.

## RESULTS AND DISCUSSIONS

Călărași county has an area of 5,087 $km^2$, being the third largest in South Muntenia Region, after Argeș (6,822 $km^2$) and Teleorman (5,788 $km^2$) counties, occupying 14.8% of the total area of the region (34,467 $km^2$) [15 ].

Regarding the territorial administrative organization, the county includes 2 municipalities (Călăraşi and Oltenița), 3 cities (Budeşti, Fundulea and Lehliu Gară), 50 communes and 160 villages. The county reisdence is the municipality of the same name - Călăraşi, which at the level of the South-Muntenia region, Călăraşi municipality represents the fourth largest municipality [3, 9].

The geographical position of the county on the border with Bulgaria and the existence of

the 2 ports on the Danube offer a special competitive advantage. Another advantage for the development of the county is given by the strategic location of the county, the municipality of Călărași, 100 km away from Bucharest and Constanța [15].

The main natural wealth is agricultural land (approx. 84% of the county area) [14]. By comparison between the counties of the region, Călăraşi county (20.4%) occupies the second place with the most extensive arable surface, after Teleorman (23.10%) [12]. The county agriculture is characterized by a preponderance of the vegetable sector, mainly oriented towards the cultivation of cereals, grains, oil plants and fodder plants [14].

Table 1. Distribution of lands on categories of use, in Călărași county, in 2021

| | Category | ha | % |
|---|---|---|---|
| 1 | **Total land** | 508,785 | 100 |
| 2 | **Agricultural** | 425,798 | *83.7* |
| | *of which :* | | |
| | ***2.1 arable*** | 410,506 | 96.41 |
| | ***2.2.vineyards and wine nurseries*** | 4,395 | 1.032 |
| | ***2.3.trees and tree nurseries*** | 207 | 0.049 |
| | ***2.4.pastures*** | 10,482 | 2.461 |
| | ***2.5.meadows*** | 208 | 0.049 |
| 3 | **Non-agricultural** | 82,987 | 16.31 |
| 4 | **degraded and unproductive lands** | 2,425 | 2.922 |

Source: INS - AGR101B - Surface of land accordign to use, in Calarasi county [12].

The soils in the area are characterized by high fertility, being made up of different types of chernozems and alluvial soils, which allow the practice of a profitable, highly efficient agriculture, especially for cereal crops, but also for other crops in the vegetable sector, as shown in Table 1, 83.7% of the surface total of the county, being owned by agricultural land, of which 96.41% is arable [12].

The localities in Călărași county that have the largest share of arable land in the total area of the land fund are those in the north and west of the county, such as: Ștefan Vodă (93.71%), Independența (92.78%), Dragoș Vodă (92, 67%), Ulmeni (91.21%) and Dragalina (90.54%). At the opposite pole are the following localities: Unirea (61.12%), Căscioarele (63.55%) [14].

The data taken from the County Directorate of Statistics show (Table 2), the fact that the approximately 600 companies active in the agricultural sector in Călăraşi county, before the COVID crisis, reported a historical turnover of 2.2 billion lei annually and an unprecedented profit [15].

The pandemic and the severe drought of 2020 caused the business to decrease in 2021 by almost 1.1 billion lei (approx. 62%), to 1.8 billion lei, lower than in 2015, representing only 59.59 % of turnover in the vegetable sector, in 2015.

Table 2. Evolution of number of companies and turnover, in Călărași county

| **Categories of private entrepreneurs** | **Year** | | | | | | **2021/ 2015 %** |
|---|---|---|---|---|---|---|---|
| | **2015** | **2016** | **2017** | **2018** | **2019** | **2021** | |
| | **UM: Number** | | | | | | |
| **Companies field Agriculture, forestry and fishing -no** | 533 | 545 | 576 | 578 | 569 | 559 | 104.8 |
| **Turnover at sector level** | thousand lei | thousand lei | thousand lei | thousandlei | thousand lei | thousand lei | % |
| **Vegetal** | 1,674,467 | 1,700,128 | 1,953,476 | 2,198,047 | 2,195,742 | 997,803 | 58.59 |
| **Animal** | 650,596 | 659,725 | 694,997 | 621,200 | 745,236 | 737,775 | 113.39 |
| **Agricultural services** | 74,456 | 71,850 | 45,966 | 60,735 | 83,745 | 61,812 | 83.02 |

Source: Data processing - County Directorate fo Statistics - Călărași [15].

Although Călăraşi County stands out for its large share of rural structures: 50 communes and 160 villages, the rural population has decreased in recent years due to demographic

aging and migration. Thus, the rural population at the county level in 2021 was 115,780 inhabitants, with 68,921 fewer inhabitants than in 2019 (184,701 inhabitants) [15]. The average size of a commune in 2021 was 2,315.6 inhabitants/community, with a 37% decrease compared to 2019 (3,648 inhabitants), and the average size of a village in Călăraşi was 724 inhabitants in 2021 /village, with a 21% decrease compared to 2019 (914 inhabitants) [15].

On 1st July 2021, the population by domicile of Călăraşi county was 305,391 inhabitants, representing 1.4% of the country population, with a density of 60.0 inhabitants/km$^2$, a low density compared to other counties in the country [12]. Within the county, a high density is found in the communes of Gălbinași (189.7 inhabitants/km$^2$), Ștefan cel Mare (141.2 inhabitants/km$^2$) and Curcani (101.8 inhabitants/km$^2$). The lowest population density is found in rural localities such as Gurbanesti (15.7 inhabitants/km$^2$), Ulmu (19.3 inhabitants/km$^2$), Dichiseni (19.5 inhabitants/km$^2$) and Frasinet (19.6 inhabitants/km$^2$) [12]. Almost 42% of the county's population lives in the countryside [13]. According to INS data, we note a reduction of approximately 33 percent in the number of people employed in agriculture in 2021 (1,681 thousand people), compared to 2013 (2,501 thousand people) at the national level [13], an aspect that was also reflected in the share of the population employed in agriculture at the level of the analyzed county. In the county, we also see a significant share of the vegetable sector (72.5%), mainly oriented towards the cultivation of grains, oilseeds and fodder plants [14]. The total cultivated area, in 2021, was 406.7 thousand hectares, lower by 0.3 thousand hectares, respectively -0.01% than in the previous year [15].

From the information presented in Table 3, it is noted that the largest arable area is cultivated with wheat, followed by corn, sunflower, rapeseed and barley, without significant changes during the analyzed period. The productions obtained in wheat, barley, corn, sunflower, soybeans place Călăraşi county in the category of large producing counties of the country.

Table 3. Surfaces cultivated with main crops in Călărași county (ha)

| Crop/Year | 2017 | 2019 | 2021 |
|---|---|---|---|
| **Wheat** | 127,196 | 121,515 | 127,714 |
| **barley** | 27,241 | 27,612 | 24,784 |
| **Maize** | 91,840 | 126,766 | 119,527 |
| **sunflower** | 37,354 | 38,126 | 35,367 |
| **Rapeseed** | 68,150 | 38,749 | 31,164 |

Source: County Directorate of Statistics - Călărași [15].

In 2021, higher productions were obtained than in the previous year for grains for grains, legumes for grains, oil plants, potatoes, melons, except for the production of vegetables. Regarding the associative environment, according to the data provided (Table 4) by the Călărași County Agricultural Directorate, at the level of 2021, agricultural activity was also carried out within the associative forms found in 8.35% of the organizational forms present in the county.

Table 4. Associative forms in Călărași county

| Organisation type in agriculture | No |
|---|---|
| family associations | 537 |
| Cooperatives | 38 |
| Producers groups | 11 |
| Other associative forms | 4 |
| Companies base don Law 31/1990 | 509 |
| agricutural companies bases on Law 36/1991 | 45 |
| Farmers | 6,458 |

Source: Călărași County Agricultural Directorate [14].

Regarding the way to carry out its activity, the form of association is influenced by the low individual possibilities of capitalization of their own family household, which does not allow it to secure all the means necessary to carry out its activities. Through association, especially if the associations have certain material means, it is possible to act in the sense of annihilating the unwanted effects of the lack of capital. [4, 5]. The concentration of production in agricultural companies of optimal size, as well as the diversification and specialization of agricultural production are closely related to the development of

association and cooperation relations along the technological flows of production of agricultural raw materials, but also regarding the processing and valorization of agricultural products.

In developing the profile of the rural area of the county, special significance is given to the particularities of the transport, health, social and educational infrastructure, on whose current state depends the level and capacity of social-economic development of Călăraşi county. As presented in Table 5, the analysis of the transport infrastructure highlights the need for its expansion, development and modernization, given that only 47.2% of the total public roads have been modernized by 2021, the share in this sense being held of national roads, respectively, 498 km out of a total of 501 km.

Table 5. Transport infrastructure of Călărași county, in 2021

| **Length of railways - total** | **km** | **188** |
|---|---|---|
| - with normal gauge | km | 188 |
| of which railways : electrified | km | 147 |
| - in % compared to tota lines | % | 78,2 |
| Density of lines at 1,000 kmp territory | | 36.9 |
| **Length of public roads – total of which:** | **Km** | **1,347** |
| modernized | km. | 636 |
| - in % compared to total | % | 47,2 |
| wth slight road covers | km. | 311 |
| - in % compared to total modernized | % | 23.1 |
| **of total public roads** | | |
| national roads | km | 501 |
| - modernized | Km | 498 |
| - with slight road covers | Km | 3 |
| county and commune roads | Km | 846 |
| - modernized | Km | 138 |
| - with slight road covers | Km | 308 |
| Density of public roads per 100 $km^2$ territory | | 26.5 |

Source: Călărași County Agricultural Directorate [15].

The water supply network serves approximately 66.98% of the total urban population and approximately 62.3% of the total rural population [15].

Compared to the other counties in the South Muntenia region, Călăraşi recorded a good situation regarding water supply, as it had the longest drinking water distribution network in the countryside and the largest number of rural localities connected to the water distribution networks drinking water in 2021 [13]. The water supply network serves approximately 62.3% of the total rural population, being present in all villages in 28 communes, partially in 20 communes and missing in 2 communes (Independenta and Vasilați) [15]. The rural sewerage network exists only in 6 localities, the extension works being carried out on government programs or non-reimbursable funds (e.g. O.G. 7/2006: municipalities Ștefan cel Mare, Vlad Țepes, Ulmu; P.N.D.R. – Measure 3.2.2. – Unirea commune, H.G. 904/2007 – Mânăstirea and Cuza Vodă communes) [10].

The population connected to sewage services is 8,600 inhabitants, representing only 4.5% of the total population [15].

The collection and evacuation of rainwater is carried out by means of ditches/street gutters generally located along the communication routes. At the level of 2021, only 9 rural localities benefited from the natural gas distribution network, but in the rural area of Călărași county there is no centralized system of thermal energy supply [15].

Regarding the accessibility of the population to the electricity network, 95.4% of the homes in rural areas were connected to the electricity network. The localities with over 10% of homes not connected to the grid are Cuza Vodă and Șoldanu [15].

The health infrastructure in the rural area of Călăraşi county, with a considerable impact on the quality of life, requires expansion and modernization measures to cover the needs of the entire population. The number of health facilities is insufficient, compared to the number of rural localities in the county, and the level of equipment is among the lowest at the national level. Also, the number of doctors serving the rural population is low (2,169 people/doctor in rural areas, compared to 418 patients/doctor in urban areas) [15]. Under these conditions, it can be considered that there is a reduced accessibility of rural residents to health services, there are localities with difficult access to primary medical assistance.

A final aspect analyzed is related to the educational infrastructure, which includes a number of 95 educational units, respectively, 11 kindergartens and crèches, 66 primary and secondary school units, and 17 high school and post-high school education units (Table 6).

Călărași county faces the problem of the insufficiency of school units in the rural environment, which causes high costs for continuing studies and implicitly a significantly higher dropout rate compared to the urban area.

Table 6. Situation of education units in Călărași county

| Categories of school units | Total | property form | | Location | |
|---|---|---|---|---|---|
| | | Public | Private | Urban | Rural |
| Creches | 1 | 1 | 0 | 1 | |
| kindergartens | 10 | 9 | 1 | 8 | 2 |
| **school units in pre-university education, of which:** | **85** | **84** | **1** | **31** | **54** |
| **primary and secondary education schools (including special education), of which:** | **66** | **67** | **1** | **17** | **50** |
| Schools in primary and secondary education | 66 | 65 | 1 | 16 | 50 |
| Schools in special primary and secondary education | 1 | 1 | 0 | 1 | |
| **School units in secondary cycle 2 education** | **17** | **17** | **0** | **13** | **4** |
| High schools - secondary cycle 2 education | 17 | 17 | 0 | 13 | 4 |
| theoretical highschools and colleges | 5 | 5 | 0 | 0 | 0 |
| Technical profile Highschools | 4 | 4 | 0 | 0 | 0 |
| Resources profile schools | 6 | 6 | 0 | 0 | 0 |
| Services profile schools | 2 | 2 | 0 | 0 | 0 |
| Schools in post high school and foremen education | 1 | 1 | 0 | 1 | 0 |
| Post highschols | 1 | 1 | 0 | 1 | 0 |
| **Total** | **96** | **94** | **2** | **40** | **56** |

Source: County Directorate of Statistics - Călărași [15].

The problems of the educational system in the rural environment have direct consequences on the economic-social situation, the need to increase the level of accessibility to the educational system for children in the rural environment being obvious.

The fact that there is a real concern of the Călărași County management for the development of the social infrastructure in the rural environment is supported by the conclusion of the Regional Pact for Employment and Social Inclusion, but still, social services are insufficiently diversified and do not cover the needs of the various disadvantaged categories. In rural areas, there is no local public transport managed by local councils, the only type of transport being that of pupils.

The identification of the material and human resources available to the rural environment of Călărași county, as well as its natural and economic potential, allowed the realization of a SWOT analysis, the conclusions of which will be the starting point for the elaboration of development proposals for the sustainable and efficient exploitation of the county's rural space.

Through the SWOT analysis, I outlined four directions that we consider priority in the implementation of the strategy for the development and exploitation of the rural space of the county, namely:

1.The infrastructure requires continuous improvement, therefore the investments must be made according to certain economic criteria so as to produce the greatest beneficial effects.

2.The economic life of the rural area must be revived and developed in all its fields: agriculture, animal husbandry, industry, trade and forestry. The local authorities will have to invest in revitalizing the economic life of the communes, this must be the number one priority, because it produces the greatest effects.

3. Creating conditions for the population's access to culture, health and education services is directly related to increasing the quality of life of the rural population.

4. Active participation of the population in the process of rural development by elaborating and implementing local development strategies and strengthening the identity of the communes [2, 9].

Table 7. SWOT analysis of the rural area in Călărași county

| **Strenghts** | **Weaknesses** |
|---|---|
| 1. Large size of the arable surface;<br>2. Good soil quality, does not require agro-ameliorative measures;<br>3. High agricultural potential (vegetable, fish and zootechnical);<br>4. Tradition in applied research in agriculture at Fundulea National Agricultural Research Institute;<br>5. High level of agricultural production;<br>6. Proximity to Bucharest in order to sell agricultural products 7. Access to the Danube, port on the Danube and border with Bulgaria.<br>8. Increasing the share of ecological agriculture in the total cultivated area. | 1. The existence of an aging human capital;<br>2. Poor qualification and professional training of the active population in the rural area;<br>3. Practicing a semi-subsistence agriculture caused by the excessive fragmentation of agricultural land;<br>4. The low level of association of agricultural producers;<br>5. The low degree of diversification of the rural economy;<br>6. The limited processing and storage capacity of agricultural and livestock products<br>7. The high degree of wear and tear of the agricultural machinery fleet.<br>8. Low degree of access to European funds in the period 2017-2020. |
| **Opportunities** | **Threats** |
| 1. European Union strategy for the Danube region;<br>2. Promotion of the strategies of the National Rural Development Program 2021-2027;<br>3. Funding opportunities through national funding programs to encourage associative forms in agriculture;<br>4. National legislation regarding fiscal facilities for associative forms in agriculture;<br>5. The absorption capacity of the common market for traditional agro-food products;<br>6. Proximity to Bucharest and Constanţa, important markets for agri-food products;<br>7. Valorization of renewable energy resources from agriculture;<br>8. Accessing funds in the period 2021-2027 for the development of infrastructure in the countryside. | 1. Climate changes that directly influence agricultural production;<br>2. The downward trend of the young population;<br>3. The high frequency of dry periods not compensated by an adequate volume of irrigation;<br>4. Insufficiency of material resources;<br>5. The uncontrolled expansion of the urban space;<br>6. The constantly changing national legislation;<br>7. The competition exercised by the products introduced on the market from import;<br>8. The difficult implementation of major and long-term investment projects due to the continuous depreciation of the national currency. |

Source: Elaborated by authors.

## CONCLUSIONS

The rural development strategy is the main tool used to blur existing social and economic disparities between regions, the gaps determined by the different degree of endowment with natural, human and financial resources of rural communities. In this sense, the development of rural communities can be described as a territorial development approach, including economic, social, cultural, political aspects, by favoring endogenous development, mobilizing the human and financial means that compete for it and ensuring their convergence

The reviving of rural communities can be done by practicing efficient agriculture, which means, equally, a better life for farmers and the village world, food security for all citizens, more legitimacy and competitiveness between the states of the European Union.

In the elaboration of proposals for the development of the communes in the rural space of Călăraşi county, the creation of a stable and diversified social-economic area, which has the capacity to ensure the general prosperity of the population and the sustainable development of the communes, must be specially pursued. Thus, the development model of the communes, on which to support their development strategy, could be built around four directions that have in mind the provision and protection of the human factor, the technical equipment and the preservation of the heritage existing in the commune, respectively: the development infrastructure and ensuring the population's access to the infrastructure, the diversification

and development of economic activities, the improvement of the quality of life, the involvement of the population in the development process of the commune. The county under study has real development possibilities based on natural, economic and human resources. The revitalization of the rural area and the sustainable development of the communes must take into account the creation of a balance between the requirement to preserve the rural area from an economic, ecological and socio-human aspect, as well as the possibility of increasing the quality of rural life, in all aspects.. The rural environment must modernize, respond to the European demands of civilizatio, but at the same time it must promote the traditions and culture specific to the area. In conclusion, the rural area of Călărași county has considerable advantages, the proper exploitation of which will have a significant impact on future economic and social development. In an economic sense, sustainable rural development is significant by adopting the latest innovations from other European countries through the vertical and horizontal integration of farm activities and the formation of rural clusters, the promotion of farms that emphasize low ecological impact and sustainable energy generation, the promotion of models modern farm management techniques to increase added value in agriculture by promoting innovation through collaboration between universities, public and private entities.

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# A MATHEMATICAL APPROACH FOR EVALUATION OF THE PURCHASED QUANTITIES OF SEVERAL TYPES OF MEAT AVERAGE PER HOUSEHOLD

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***Abstract***

*The current paper presents a mathematical approach for evaluation of the purchased quantities of several types of meat average per household in Bulgaria. The investigated groups of data are stored in a relational database. They include the following eight considered elements - pork meat, lamb meat, minced meat, poultry meat, mutton and goat meat, edible offals and bacon. Certain set of variables have been calculated and analysed during the studied period (2010-2021). The pace of change of the indicated variableshas also been discussed for the mentioned years. It significantly supports users in decision making and presenting the obtained conclusions about the examined objects.The share of average purchased quantities per household for poultry meat is higher in comparison with that for the other investigated types of meat for each one year of the period. The pace of change of the examined indicator for the pork meat is comparatively more intensive in 2019-2021. Only, the values of this indicator for edible offals decreased continuously for ten of the considered twelve years.*

***Key words*****:** *approach, database, evaluation, quantities, types of meat.*

## INTRODUCTION

Gathering data has become a main function for organizations not only in keeping the documentation but also in helping different tasks related to data analysis which are very important. However, it should be noted that a widespread and serious problem for almost every organization is the quality of the data.The presence of incorrect or contradictory data can greatly distort the results of the analysis [11]. The information must be correct, actual and presented in an appropriate form, regardless of whether it is obtained from a paper or electronic source [16]. This requirement shall be imposed in connection with the subsequent processing of the data.

Some data analysis methods require a certain way of presenting the data[8].Very often the searched information is located in different files.There are cases where it needs to be structured and saved in one source. This would provide significantly faster access to the separatestudied objects.In this regard, relational databases [6], [3], [4] are widely used to store different information from the field of economics and agriculture.

The data on the purchased quantities of the relevantfood types are presented into a built relational database in the current work.They are provided from the Bulgarian National Statistical Institute [14]. Subsequently, this information is found and extracted from the website of the mentioned organization.The obtained data are distributed in the built tables. The designed database contains the following relational schemes, as is shown in Fig.1:

- Objects (objects_id, characteristics, name_object,);
- Foods (objects_id, name, id_f);
- Types (id_t, name, id_f);
- Quantities (Id_q, year, unit, quantity, id_t,);
- Avg_Prices (Id_1, year, id_t, average_price).

The Objects table is related to the Foods table. The Foods table is related to the Types table. The Types table is related to two others (Avg_Prices and Quantities). The indicated relationships between the considered tables are of one-to-many type.

The current work presents a mathematical approach for evaluation of the purchased quantities of several types of meat average per householdin Bulgaria. Meat is one of the main foods (Grunert K. G., 2006) [9]. In an economic aspect, the competitiveness reflects the possibility of a certain product being sold at a lower or equal price compared to that of competitors and reveals the competitive market potential of the firm (Kostadinova N., 2010) [13]. Consumers place significant priority to improvements in animal husbandry and the animal welfare [13].

The study of Cosgrove M.and Kiely M., 2005 [2] notes that "Meat is a nutrient dense food and meat and meat products are an important source of a wide range of nutrients. The protein content of meat is of high biological value with many essential amino acids"[2]. According to Henchion M.,et al., 2014 "Meat consumption has increased and is likely to continue into the future. Growth is largely driven by white meats, with poultry in particular of increasing importance globally" [12]. The same authors also point out that "The influence of factors such as income and price is likely decline over time so that other factors, such as quality, will become more important" [12].

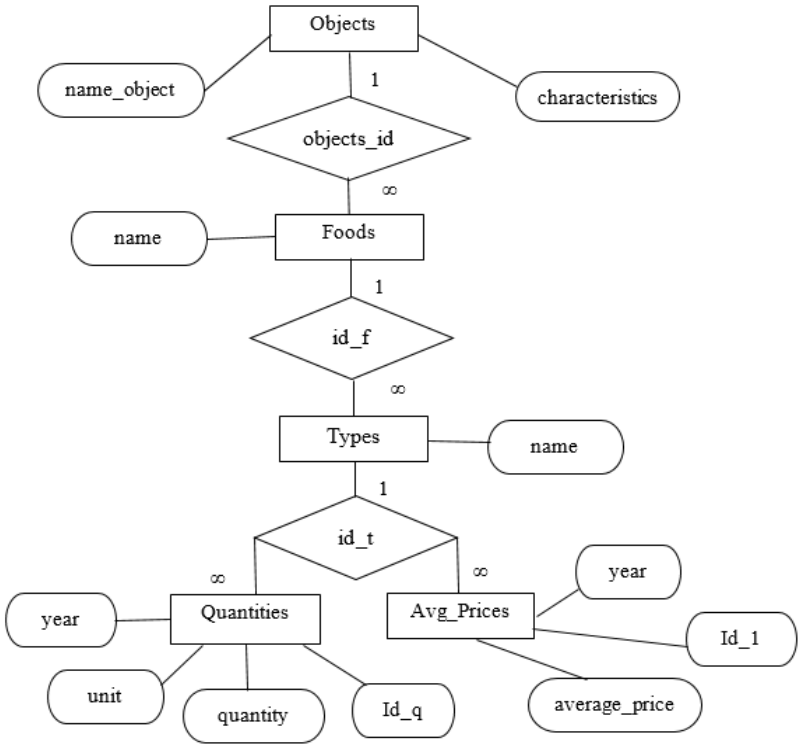


Fig. 1. Presentation of the builtmodel
Source: Own conception.

## MATERIALS AND METHODS

The information concerning eighty-threefood types in the interval 2010-2021 has been presented in the above-mentioned database. The object of consideration in thispaper are several types of meat. They are the following:

- Pork;
- Lambmeat;
- Mutton and goat meat;
- Minced meat;
- Poultry meat;
- Edible offals;
- Bacon.

The values of the studied indicators related to these eight listed elements are searched and found from four tables of the indicated database.Users could visualize data only for selected objects, as well as for selected years of the time interval. It should also be noted

that they could integrate the information from several tables [5] and could create different reports or queries [15].

The present work estimates the average purchased quantities per household of the listed eight types of meat. In this regard, the following components should be calculated:

- $A_p = \sum_{r=1}^{q} a_{pr}$ .....(1)

where: $a_{pr}$ - the averagequantity of relevant type of meat for a certain year; q=12, $p \in \overline{1;7}$, $A_p$ - total averagequantities;

- $B_r = \sum_{p=1}^{w} a_{pr}$ .....(2)

where: w=7, $r \in \overline{1;12}$ ; $B_r$ - total averagequantities of the examined meattypes during r[th] year;

- $G_{pr} = \frac{100.a_{pr}}{B_r}$ .....(3)

where: $p \in \overline{1;7}$, $r \in \overline{1;12}$ and $G_{pr}$ - the share of the respective average quantities of the meat type to the total average quantities of the meat types for the certain year;

- $U_p = \frac{100.A_p}{B_1 + B_2 + ... + B_{12}}$ .....(4)

where: $p \in \overline{1;7}$, $U_p$ - the share of the average quantities of relevant type of meat to the total average quantities of the listed meat types for the studied period;

- Difference – $T_r$

$T_r = t_{max\,r} - t_{min\,r}$ .....(5)

where: $r \in \overline{1;12}$, $t_{max\,r}$ - the highest value of the purchased quantitiesaverageper household of theinvestigated type of meat during r[th] year, $t_{min\,r}$ - the lowest value of the purchased quantitiesaverageper household of the mentioned object for r[th] year.

The current work discusses and analyses theseabove-indicatedvariables as well as their pace of change for the presented years from theconsideredperiod. It significantly supports users in decision making andpresenting the obtained conclusions about the examined objects.

This information canalso be stored and used in the future.

The data concerning the studied eight types of meat, average per household are processed byusing MS Excel [1], [10]software product.

## RESULTS AND DISCUSSIONS

The purchased quantities of the listed eight types of meat are studied in the interval from 2010 to 2021. Users have the ability to extract groups of data from the created database based on predefined and selected indicators. Usually, the necessary information is searched in several tables from the database.In this connection, the relational algebra operations [7] that need to be performed are selection, projection or joins [15].

The extracted and visualized groups of data include:

- the values of the investigated indicator for selected type of meat during this twelve years interval;
- chosen meat types and their characteristics;
- the examined indicator for these eight types of meat for a given year from the indicated period;
- the indicator values for certain meat types during chosen years.

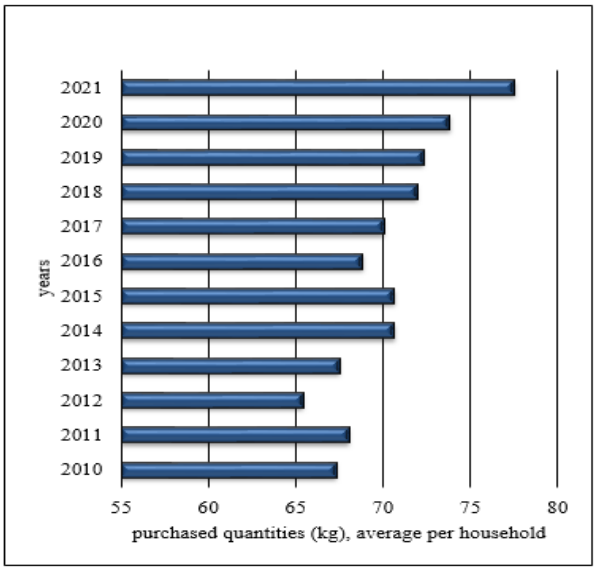


Fig. 2. Visualization of the obtained values of the component $B_r$

Source: Own calculations on the basis of data from [14].

The current paper evaluates these groups ofdata related to the average purchased quantities per household of the studied eight types of meat during the whole indicated period as well as for each individual year.

The analysis of the obtained values of the mentioned component $B_r$ (Fig. 2)shows that they grow continuously for the last five years. Therefore, in this time segment, the investigated indicator for the considered types of meat increased by about 17 kg. Certain reduction was established in 2012 and 2016 by 2.6 kg and 1.8 kg, respectively. A rather different situation occurred in 2014 as well as 2015. The calculated values of $B_r$ are equal. This means that thetotal purchased quantities of these meat types, averageper household for the listed two years are the same. The results of the data processing related to the next examined component $G_{pr}$ are displayed in

Table 1. Calculated values of thecomponent $G_{pr}$ in the time segment 2010-2021

| Year | Poultry meat | Minced meat | Pork meat | Edible offals | Lamb meat | Mutton and goat meat | Bacon |
|---|---|---|---|---|---|---|---|
| 2010 | 34.47% | 28.08% | 22.44% | 11.00% | 3.12% | 0.59% | 0.30% |
| 2011 | 34.12% | 28.53% | 23.68% | 10.74% | 2.21% | 0.44% | 0.29% |
| 2012 | 33.49% | 27.37% | 25.38% | 11.01% | 1.99% | 0.46% | 0.31% |
| 2013 | 32.89% | 26.96% | 26.37% | 10.37% | 2.52% | 0.44% | 0.44% |
| 2014 | 33.57% | 24.79% | 28.05% | 9.77% | 2.97% | 0.42% | 0.42% |
| 2015 | 33.99% | 23.51% | 30.31% | 9.35% | 2.27% | 0.28% | 0.28% |
| 2016 | 32.99% | 22.82% | 30.96% | 9.30% | 3.20% | 0.44% | 0.29% |
| 2017 | 33.43% | 23.14% | 30.14% | 9.29% | 3.14% | 0.43% | 0.43% |
| 2018 | 33.38% | 21.56% | 31.99% | 8.90% | 3.48% | 0.28% | 0.42% |
| 2019 | 34.72% | 22.13% | 30.71% | 8.58% | 3.04% | 0.41% | 0.41% |
| 2020 | 33.74% | 22.22% | 31.71% | 7.99% | 3.39% | 0.41% | 0.54% |
| 2021 | 33.16% | 21.03% | 34.19% | 7.48% | 3.48% | 0.26% | 0.39% |

Source: Own calculations on the basis of data from [14].

Table 1. The share of poultry meat is higher compared to the shares of the other investigated types of meat for each one year of the considered period.Two things should be pointed out here.On the one hand, it seems that the consumption of white meat in households is higher.And on the other hand, it should be noted that the price of poultrymeat is lower than that of some other types of meat such as pork, lamb, mutton and goat meat and minced meat.One more interesting fact should be mentioned.The calculated values of $G_{pr}$ are relativelylowerfor one of the examinedelements(in this case, bacon) for nine of the indicated twelve years. This researched indicator for mutton and goat meat is the lowest only in2018 as well as in the last two consecutive years 2020-2021. The pace of change of the examined indicator (purchased quantities) for the pork meat is comparatively more intensive in the time segment 2019-2021. Here, the growth is about 4.3 kg.This process is relatively smootherfor another studied element. In this case, major changes in the mentioned indicator for minced meat were not established in 2016-2020. A similar summary can be made for one of the examined objects - poultry meat during the last three years from the indicated period.Only, the values of the researched indicator for edible offals decreased continuously for ten of the considered twelve years (2011-2015 and 2017-2021). The pace of change of the average purchased quantities per household for lamb meat was quite dynamic. Four sub-periods were formed in which the indicator decreased and then increased gradually. The indicator values for mutton and goat meat remained the same in eightnon-consecutive years.

An evaluation of the considered groups of data for the whole studied period was carried out. As can be seen from Fig. 3, the share of the average purchased quantities per household of poultry meat is 33.66%. This calculated value of the component $U_p$ is about 4.7% and 9.1% higher than the obtained values for the second and the third element (pork meat and minced meat), respectively. The shares of mutton and goat meat and bacon are much lower. In addition, low values of this variable $U_p$ were also calculatedfor other twogroups of data.In this case, these are edible offals and lamb meat.

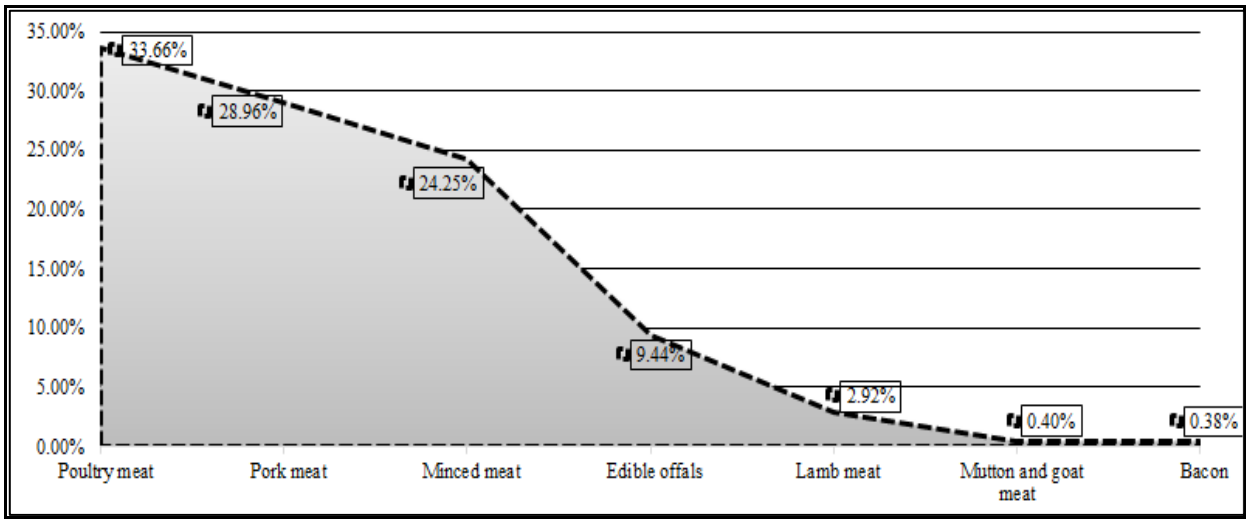


Fig. 3. The change of the component $U_p$ for the studied eight elements

Source: Own calculations on the basis of data from [14].

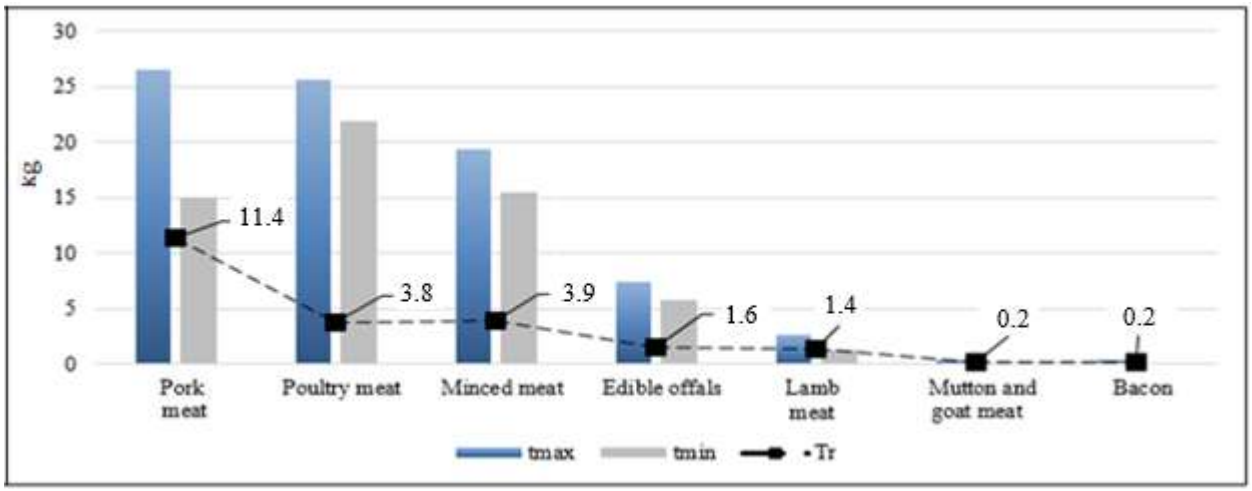


Fig. 4. Results for the difference $T_r$

Source: Own calculations on the basis of data from [14].

The present paper also analyses the obtained values of the component $T_r$ (Fig. 4). The difference between the highest and the lowestvalue of the examined indicator (averagepurchased quantitiesper household)for porkduring the considered period is 11,400 kg. The studied values of $T_r$ for poultry meat and minced meat are about 3 times smaller than theseones for the mentioned element (pork). As can be expected, the variable $T_r$ has the lowest values for bacon and mutton and goat meat. Figure4shows that this indicated variable has

low values for the following elements - lambmeat and edible offals.

## CONCLUSIONS

The examined data related to different types of meat are presented in four tables of the indicated database. Users can extract groups of data from the database based on predefined and selected indicators.This obtained information can be studied.

A mathematical approach for evaluation of purchased quantities of several types of meat average per householdin Bulgaria is presented in the paper. The considered period includes the years between 2010 and 2021. The mentioned types of meat are the following:

- Pork;
- Lambmeat;
- Mutton and goat meat;
- Minced meat;
- Poultry meat;
- Edible offals;
- Bacon.

The results of the performed evaluations in this paper show:

- The share of average purchased quantities per household for poultry meat is higher in comparison with that for the other examined types of meat for each one year of the considered period. Theshare of one of the examined elements(in this case, bacon) for nine of the indicated twelve years is relativelylower;

-The pace of change of the examined indicator for the pork meat is comparatively more intensive in the time segment from 2019 to 2021. The indicator values for mutton and goat meat remained the same in eight non-consecutive years;

- The values of the indicator (average purchased quantities per household) for edible offals decreased continuously for ten of the indicated twelve years.

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# THE PANDEMIC, A CHANCE FOR AN AUTHENTIC ROMANIAN RURAL TOURISM

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***Abstract***

*The pandemic has caused a contraction in hospitality business and sifted through Romanian tourism, creating a real chance for authentic rural tourism. The characteristic economic indicators for the period 2020-2021 are presented, highlighting the decreasing trend in the degree of occupancy especially in large hotels, according to INSSE statistics. The organizational specifics of a tourist unit - a guesthouse - in a Muntenia authentic household, were analyzed. This type of authentic peasant household organization, with accommodation units distributed within a large, spaced courtyard, provided the opportunity to carry out a tourism activity in a mandatory by low safe, sanitary conditions. This led to the continuation of this business and the development of the local tourism offer. It can thus be said that authentic Romanian tourism, organized in the typical way of a traditional household, offered a viable alternative for the continuation of hospitality in a critical period of the pandemic, characterized in general by a decrease in this activity.*

***Key words*****:** *pandemic, rural tourism, authenticity, guesthouse*

## INTRODUCTION

The pandemic has caused a contraction in hospitality business. During 2020 - 2021, tourist trips were canceled or rescheduled to reduce the impact of the sanitary crisis on health. A series of specific measures were imposed by the authorities so that the touristic structures that remained open were the ones that could host a limited number of people, respecting social distancing, PCR tested or with a vaccination certificate, measures also applicable to the staff. (Decree no. 195 of March 16, 2020) [3]. Large tourist units, with common access or dining areas that can host a large number of tourists, with air conditioning, spa, swimming pools, could not fulfill these conditions and were forced to temporarily close the activity (Stoicea, P. 2021) [10]. Against this background of massive contraction of the hotel activity, the small tourist units like rural guesthouses, specifically organized with accommodation places dispersed in an authentic household, had the opportunity to continue their activity respecting the imposed sanitary norms. Thus, a real relaunch of the activity was achieved on this level with the increase in the rate of this type of rural tourism, thus promoting authentic Romanian tourism.

In this context, the purpose of the paper is to analyze the trend of occupancy degree during the Covid-19 pandemic in Romania to highlight what happened in hotel industry and also in guesthouses, especially profiled on agritourism.

An authentic study case of a rural guesthouse from Muntenia region is described in order to prove that small accommodations of this type, based on traditional rural household, became more attractive than hotels for tourists during the pandemic.

## MATERIALS AND METHODS

Some characteristic economic indicators for the 2020-2021 period are presented, highlighting the decreasing trend in the degree of occupancy in large hotels and guesthouses, as well as the increase in the rate of tourism in small agritourism guesthouses, according to INSSE statistics.

The organizational specifics of a tourist unit - the guesthouse - in an authentic Muntenian

household were analyzed. This type of organization of an authentic rural household, with the accommodation units distributed inside a large, spaced courtyard, provided the opportunity to carry out the tourist activity in safe, sanitary conditions.

## RESULTS AND DISCUSSIONS

There is a marked decrease in the number of overnight stays in tourist units in 2020. In total, this decrease was 51.4%, of which for Romanian tourists with 45.22%, and for foreign tourists with 81.15%. This decrease is reduced in 2021 by only 30.75% in total, respectively for Romanian tourists by 23.36% and by 65.36% for foreign tourists.
In total, the recovery trend of this tourist index (overnight stays) in 2021 was 69.25%, with 76.63%, for Romanian tourists and with 34% for foreign tourists (Figure 1).

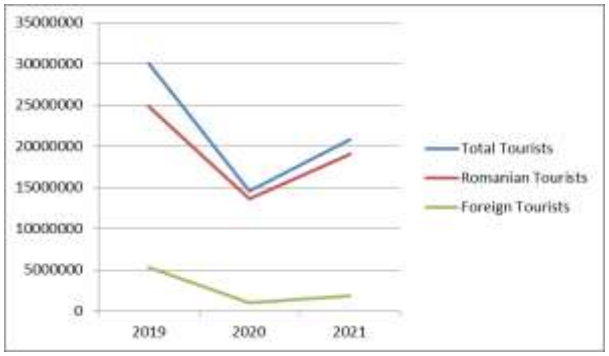


Fig. 1. The decrease in total number of total tourists, Romanian tourists vs foreign tourists during the period 2019 – 2021
Source: Own design based on the data from NIS-INSSE, 2023 [7].

Although sudden, the contraction of the activity in the tourism field mainly interested large and medium-sized hotel units. This can be seen from the comparative aspect of the decrease in activity from 2020 by 51.54% for all accommodation units compared to only 39.8% for agro-tourism guesthouses.
In 2021, the decrease in the number of tourists was more accentuated in large hotel units, by 30.75%, compared to agritourism guesthouses, where the decrease was only 17.03% (Figures 2 and 3).

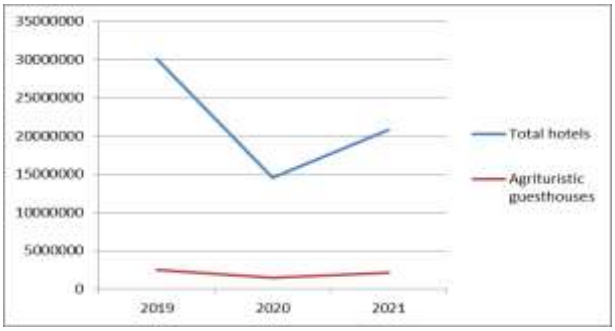


Fig. 2. Decrease in tourist activity in terms of overnight stays per total number of hotels vs agro-tourism guesthouses
Source: Own design based on the data from NIS-INSSE during the period 2019-2021 [7].


Fig. 3. Percentage decrease in tourist activity in terms of overnight stays per total number of hotels vs agro-tourism guesthouses
Source: Own design based on the data from NIS-INSSE during the period 2019-2021 [7].

With a much lower percentage of tourists compared to the total number of accommodation units in 2019 -8.37%, the agro-tourism guesthouses had in the most critical year, 2020, an increasing share in terms of tourist accommodation, 10.39% of the number total and maintained at 10.02% in 2021 (Figures 4 and 5).

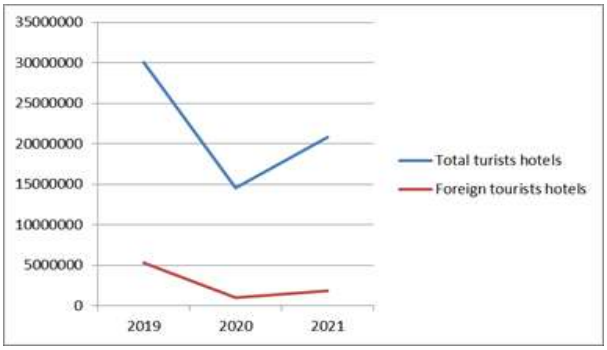


Fig. 4. Decrease tourist activity - total tourists vs foreign tourists in hotels
Source: Own design based on the data from NIS-INSSE during the period 2019-2021 [7].

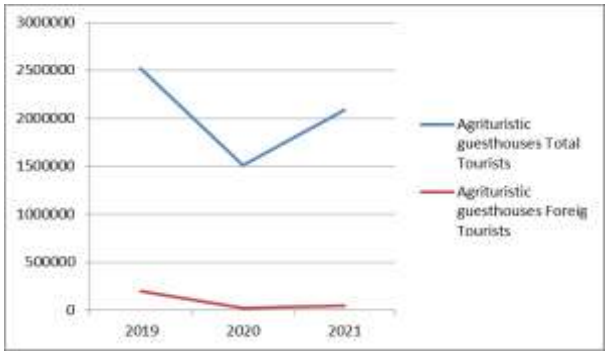


Fig. 5. Decrease tourist activity - total tourists vs foreign tourist in agriturisic guesthouses
Source: Own design based on the data from NIS-INSSE during the period 2019-2021 [7].

For the time being, there is no clear data in the specialized literature or in the statistical databases regarding the evolution of turnover during this period for authentic, traditional rural tourism. But we can state the trend of increasing the number of foreign tourists interested in this part of Romanian tourism. The statistical data are eloquent regarding the demand and attendance by foreign tourists of the units with traditional or regional specifics - a significantly smaller decrease of foreign tourists compared to the total number of tourists. This can be explained by the search for new destinations, distinguished by the local specificity of the accommodations, in authentic houses, local gastronomy and historical circuits, especially under the conditions of the pandemic restrictions.

Thus, foreign tourists were able to get to know a new, specific and characteristic aspect of traditional Romanian hospitality, a distinctive factor, encountered more and more often in the tourism offer in our country. The advertising impact achieved through the purchase of properties by the British royal family in Romania, the production in recent years of some documentary films about the simplicity and authenticity of rural life as well as the wealth of pre-Christian and Christian customs well preserved in our villages, have opened the appetite of tourists for frequenting some areas and fields less sought after in the pre-pandemic years.

In this sense, the tourist offer of the rural guesthouses fit like a glove in the conditions where the large network of hotels and guesthouses have drastically reduced their activity. The elements that led tourists to choose rural and agriturism guesthouses as vacation destinations during the pandemic period are, on the one hand, the specific sanitary conditions and, on the other hand, a particular way of organizing a country household. The imposed sanitary conditions have drastically reduced the offer of large hotels, while at the same time the way country households are organized have offered safe and comfortable accommodation opportunities.

The organization of a specific Muntenian household follows the traditional principles of rural construction as it appears from the architectural plans presented in the specialized literature (Order of Architects of Romania, 2017) [8].

The villages of Prahova Valley, in the submontane area, were located at the intersections of important commercial roads. The peculiarity of this individual households is the withdrawal of the house from the main road, in the center of the property (Photo 1). The suite of main annexes were structured around the big house: the cellar, the summer kitchen, the stable and hay deposit, the corn warehouse (the barn), the craftsman's workshop. All these buildings and outbuildings can exist together, but more often they are independent, located at a distance in the large courtyard, specific to traditional practices (Hoinarescu C., 2013) [4].

Photo 1. Big house in the center of the property
Source: Original.

Thus, in Satul Banului Village, in the commune of Magureni, Prahova, the guesthouse is organized according to the

typical local smallholder property – named "gospodărie moșnenească", offering tourists accommodation, local gastronomy based meals and cultural tourism (Dinica Ciobotea, 2010) [2].

Unlike the rural modern houses and at the same time specific to this area, the main house, also called the big house, is set back from the street inside the courtyard, necessarily surrounded by vegetation (Photo 2).

Photo 2 . Big house sorrounded by vegetation
Source: Original.

The house is built on two levels, in the lower part is the storage area - the cellar, the larder. On the upper floor are the living rooms.

The porch and the pavilion are characteristic elements of the Muntenia area (Photo 3). Extended on one, two or three sides of the house, the porch has both an aesthetic but also a practical role (Stoica G., 1989) [9].

Photo 3. The big house, the stable and the summer kitchen
Source: Original.

Thus, in the big house, tourists are offered three accommodation rooms with all the utilities and a space for serving meals inside or outside on the porch (Order of Architects of Romania, 2017) [8].

The stable is structured on two levels. On the lower level, where the animal shelter used to be, there is a social space and the dining room, and on the upper level - the old hay deposit is organized into 3 rooms with private bathrooms (Photo 4).

The main kitchen of the pension found its natural place on a lower level of the ground floor, built of river boulders - a characteristic element for the houses in this area (Ionescu G., 1957) [6].

Photo 4. The stable
Source: Original.

On the other side of the yard is the corn warehouse, the structure suspended on pillars, used for grain storage. It is equipped with 2 fully equipped rooms. Under the barn is the socializing and dining area, open, in direct contact with nature (Photo 5).

Photo 5. The cornwarehouse
Source: Original.

The carpentry workshop, a craft of the owner's grandfather, is set up as a separate accommodation unit, on two levels, with all utilities. The dining area is set up in front of the workshop (Photos 6 and 7).

Photo 6. The carpentry workshop
Source: Original.

Photo 7. The carpentry workshop – interior view
Source: Original.

The summer kitchen has a socializing and dining area on the lower level and a living room with full utilities on the upper level (Photos 8 and 9).

Photo 8. The summer kitchen
Source: Original.

Tourists staying at the property can benefit from such independent accommodation spaces in the main house or annexes arranged for tourist purposes.

Photo 9. The summer kitchen upper level
Source: Original.

The dining area is also separate for each accommodation unit. In this way, 4 places to serve meals could be used, corresponding to the accommodation spaces, spaced apart. The shift in the meal service schedule was also introduced so that the staff would specifically serve each group of tourists, separately.

Although the sanitary conditions imposed rules and procedures specific to the pandemic, it was possible to create a safe, pleasant, discreet but at the same time hospitable environment in the true sense of the word, specific to local Muntenian traditions.

This was emphasized by the continuously promoted local gastronomy, from which no discount was made. The complete, healthy diet used by our great-grandparents has been brought back to the tourists' tables, reinvented here and there but keeping all the original organoleptic properties as well as the vitamin nutritional value so desirable in this critical period all made from fresh or preserved products collected from the garden.

## CONCLUSIONS

The traditional constructive elements: the location of the buildings in the household, the presence of specific architectural elements: the independent porches, the pavilion, have created an authentic Romanian hospitality structure that has found its perfect functionality especially in pandemic conditions, tourists being protected and respecting the imposed sanitary conditions

(maximum number of tourists, social distance).

This type of rural tourism guesthouse was able to operate continuously during the pandemic, during which large hotels were forced to reduce their activity precisely due to the impossibility of respecting the conditions imposed by social distancing.

It can thus be said that authentic Romanian tourism, organized in the typical way of a traditional household, offered a viable alternative for the continuation of a hospitality activity in a critical period of the pandemic, characterized by a decrease in activity in general.

Although it decreased during the pandemic, the tourist flow in the rural guesthouses represented a relative constant in terms of the continuation of the activity. Thus the pandemic sifted through Romanian tourism, creating a real chance for relaunching authentic rural tourism.

The positive signal given by rural guesthouses can be continued through an intense promotion through the specific ANTREC and HoReCa networks [1, 5] but also through governmental support of small tourist units through public-private partnerships.This represent an intrinsic value, promoting Romania through what it has most valuable, authenticity. Thus, rural tourism can become a way to revitalize the life of villages, having many positive effects, increasing productivity and incomes at the local level based on the principles of a sustainable economy.

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# THE MANAGEMENT OF PUBLIC PROCUREMENT FOR SUSTAINABLE AGRICULTURAL PRODUCTS

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***Abstract***

*The purpose of this paper is to present the procedure of managing public procurement contracts for sustainable agricultural products from the public entities perspective (with reference to setting criteria for selecting the suppliers, contract management, etc), but also from the perspective of the selling companies (from drafting the tender to products being delivered). The research is based on data processed by Eurostat (2012-2021), but also on information taken from the Romanian Electronic Public Procurement System (2018-2022). The analyses in the paper concern indicators such as: the procurement of agricultural products from Romania, and at European level the organic production of animal products, the number of processors of sustainable agricultural products, etc. In conclusion, since the public institutions buy large quantities of agricultural products, but the market for sustainable agricultural products is restricted, a global strategy for rethinking the public procurement in this area is clearly required. The work is relevant both for the contracting authorities with respect to the management of public procurement for agricultural products, but also for the companies with respect to the business management of public contracts.*

***Key words*: *public procurement, management, agriculture, sustainability***

## INTRODUCTION

The continuous demand for agricultural products in public institutions (hospitals, military units, school/student cafeterias, social insurance centres, etc.) is a driving force for the development of farms, processing companies and those working in the food industry. The development of the economy in accordance with the Green Deal policies and the Farm to Fork strategy puts pressure on the entire food chain [16]. Public authorities, with the large volumes of agricultural products in the procurement process, can be a good example in the implementation of sustainability regulations [2]. Purchasing organic products requires that they are provided from sustainable agriculture and be part of a sustainable food chain [17].

The management of public contracts for the supply of organic agricultural products requires thorough knowledge on the part of the purchaser, so that he is able to draw up tender documentation in line with the applicant's requirements and sustainability conditions. Establishing technical specifications for agricultural products, growing conditions, identifying qualification criteria, evaluation factors, verifying that products are produced in an environmentally friendly way - all these may represent significant challenges for the contracting authorities. In Romania, the value of food products purchased by public institutions, based on the tendering procedures established by Law No. 98/2016 [14], can be determined by querying the platform of the Electronic Public Procurement System (EPPS) [3].

The originality of the research carried out in this paper is achieved by presenting and discussing the management stages of sustainable food supply contracts awarded under public procurement legislation.

This paper includes a section on the research method and materials used; a chapter on results and discussion, presenting analyses on organic production based on information provided by the European statistical system EUROSTAT and the EPPS platform regarding the public procurement of food products in Romania for the period 2018-2022. The last section of the paper is dedicated to the conclusions, where the authors' observations and potential topics for future research development are presented.

The aim of the research is to demonstrate the role of public institutions in the development of sustainable agriculture, organic food production and the possibility for economic operators to increase their business through public procurement contracts.

## MATERIALS AND METHODS

The paper is based on information from EPPS on contracts awarded in the area of "Agriculture and Food" during the period 2018-2022.

The data have been centralised and presented graphically using tables, according to the type of procurement procedures.

Based on this information, the value evolution of food supply contracts was determined. Information from the EUROSTAT database on statistical data on organic processors, meat and milk production from 32 countries was used.

The documentation was carried out using the Web of Science, Scopus, Google Scholars databases and papers that researched organic food, European agricultural policies such as the Green Deal [5] and public procurement of organic food were selected. The European Union recommendations, the European Commission directives, as well as those of the national legislation on organic and conventional public procurement have been taken into account in the elaboration of this article.

## RESULTS AND DISCUSSIONS

The Communication COM 400 (2008) of the European Commission defines the Green Public Procurement (GPP) as the process by which public entities can purchase various works, services and products with a reduced environmental impact over their lifetime, as opposed to purchases other than GPP for the same. Among the priority sectors listed in this Commission Communication are food and catering services. The food industry has the capacity to address environmental sustainability and human health [21]. Public procurement can be considered "green" if it is provided by a public contract that complies with the criteria of good green production practices [4].

### 1.Organic Food Processors Market by EUROSTAT

The increased demand for sustainable food is driving more and more farmers into organic farming. Implicitly, the processors of food raw materials are forced to change the way they work, so that the final products are labelled as organic (organic or biological, the terms being equivalent). The role of organic farming is to provide clean, sustainable food that is appropriate for the human metabolism [19, 20]. The conservation agriculture practices have been promoted by the Food and Agriculture Organization of the United Nations (FAO) as an alternative to intensive farming methods [12]. The three key objectives of conservation agriculture (crop diversification, reducing soil pollution, continuous cultivation of agricultural area) should be reflected in the activity of every farm [1]. Such practices are suitable for the development of organic farms with the reduction of climate change impacts on agriculture (Alwin and Ashok, 2018). The transition from conventional to organic farming is a difficult process that requires both a change of mentality and a substantial financial effort.

From data provided by EUROSTAT, based on the information obtained from 32 countries (including Romania), for the period 2012-2021, it can be seen that, in most countries, the trend has been for a continuous increase in the number of processors of organic products, with Romania ranking the 25th at the European level (Table 1).

Table 1. Processors of organic products

| Country | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| France | 614 | 599 | 616 | 1,181 | 1,231 | 1,468 | : | : | : | : | 5,709 |
| Italy | 423 | 525 | 515 | 470 | 513 | 695 | 822 | 819 | 686 | : | 5,468 |
| Spain | 365 | 361 | 356 | 351 | 395 | 454 | 464 | 540 | 578 | 610 | 4,474 |
| United Kingdom | 317 | 348 | 384 | 260 | 258 | 494 | 455 | 292 | : | : | 2,808 |
| Netherlands | 202 | 172 | 206 | 204 | 200 | 200 | : | 208 | 209 | 207 | 1,808 |
| Sweden | 113 | 105 | 143 | 157 | 176 | 184 | 196 | 183 | 175 | 145 | 1,577 |
| Denmark | 134 | 141 | 141 | 182 | 192 | 192 | 156 | 163 | 162 | : | 1,463 |
| Czechia | 76 | 87 | 104 | 131 | 146 | 124 | 143 | 174 | 182 | 217 | 1,384 |
| Norway | 81 | 75 | 77 | 93 | 122 | 99 | 152 | 125 | 128 | : | 952 |
| Belgium | 99 | 71 | 76 | 90 | 93 | 95 | 117 | 119 | : | : | 760 |
| Finland | 53 | 90 | 96 | 81 | 104 | 84 | : | 87 | 80 | 74 | 749 |
| Greece | 35 | 39 | 49 | 42 | 44 | 39 | 47 | 46 | 46 | : | 387 |
| Portugal | 21 | 21 | 30 | 35 | 34 | 35 | 36 | 40 | 47 | 44 | 343 |
| Ireland | : | : | 28 | 39 | 27 | 46 | : | 29 | 28 | 46 | 243 |
| Poland | 23 | 11 | 25 | 29 | 29 | 27 | 29 | 35 | 35 | : | 243 |
| Hungary | 24 | 26 | 28 | 20 | 15 | 13 | 16 | 22 | 12 | 12 | 188 |
| North Macedonia | : | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Slovenia | 16 | 16 | 15 | 14 | 22 | : | 21 | 23 | 21 | : | 148 |
| Latvia | 13 | 14 | 17 | 16 | 22 | 27 | : | 24 | : | : | 133 |
| Estonia | 6 | 8 | 12 | 14 | 14 | 13 | 12 | 14 | 18 | 19 | 130 |
| Türkiye | : | 13 | 20 | 18 | 10 | 7 | 6 | 7 | 8 | : | 89 |
| Slovakia | 6 | 6 | 8 | 10 | 12 | 11 | : | 13 | 12 | : | 78 |
| Lithuania | 3 | 3 | 3 | 7 | 5 | 7 | 5 | 8 | 8 | 11 | 60 |
| Luxembourg | : | : | 6 | 7 | 7 | 8 | 9 | 7 | 6 | 7 | 57 |
| **Romania** | **1** | **1** | **0** | **3** | **5** | **5** | **:** | **4** | **8** | **8** | **35** |
| Croatia | 1 | 2 | 2 | 1 | 3 | 4 | 5 | 7 | 0 | 0 | 25 |
| Bulgaria | 0 | 1 | 1 | 5 | 0 | 1 | 1 | 1 | : | 2 | 12 |
| Serbia | : | 0 | 2 | 1 | 1 | 0 | 3 | 3 | 2 | : | 12 |
| Cyprus | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| Iceland | : | : | : | : | : | : | 1 | 1 | 2 | : | 4 |
| Malta | : | 0 | 0 | : | : | 0 | 0 | 0 | 0 | 0 | 0 |
| Montenegro | : | : | : | : | : | : | : | : | : | : | 0 |

Source: Authors, by using Eurostat (2022) [7].

Between 2012 and 2017, the number of organic processors was relatively constant, the peak being recorded in 2017. The decrease in their number during 2020-2021, below the 2018 level, was also influenced by the COVID 19 pandemic which slowed down the development of all industries globally and nationally (Figure 1).

The transition from conventional to sustainable agriculture requires both a change of mentality and a substantial financial effort.

The dynamics in organic food production are relatively slow, although countries with advanced mechanised agriculture are being able to adapt more easily to this requirement (Figure 2).

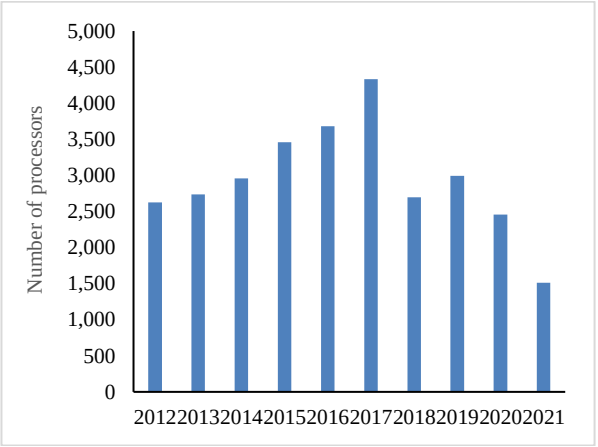


Fig. 1. Number of processors of organic products
Source: Authors, by using Eurostat (2022) [7].

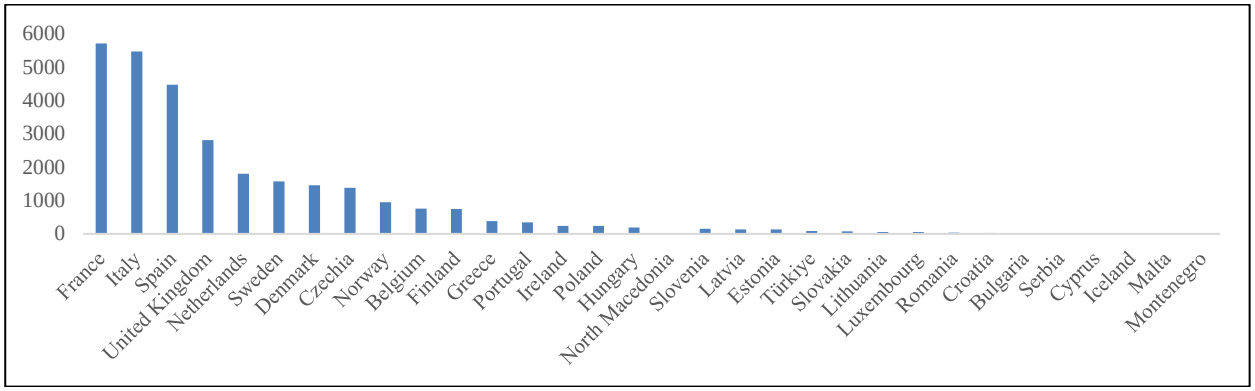


Fig. 2. Processors of organic products
Source: Authors, by using Eurostat (2022) [8].

The sustainable agriculture has developed mainly on livestock farming. Eurostat statistics include several organic animal products, with high values for beef and milk.

The sustainable agriculture has developed mainly on livestock farming. Eurostat statistics include several organic animal products, with high values for beef and milk.

Table 2. Beef and veal (tons)

| Beef and veal | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|
| 32 countries | 77,831 | 95,720 | 150,275 | 135,109 | 106,968 | 116,710 | 133,508 | 132,942 | 115,045 | 88,064 |
| Romania | no data | no data | no data | no data | no data | no data | no data | no data | no data | 14 |
| % | | | | | | | | | | 0.016 |

Source: Authors, by using Eurostat (2022) [8].

As far as milk production is concerned, Eurostat centralizations show increasing quantities in the period 2012-2020. In 2021, due to the pandemic, milk production fell below the level of previous years, with Romania accounting for about 1.19% of the total reported by the 32 European countries included in the analysis (Table 3 and Figure 3).

Table 3. Raw milk products (tons)

| Raw milk | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|
| 32 countries | 2,791,737 | 3,486,346 | 4,255,395 | 4,162,054 | 4,575,863 | 5,060,846 | 5,386,254 | 5,716,372 | 6,051,474 | 33,59,682 |
| Romania | no data | no data | 35,945 | 38,478 | 34,995 | no data | 28,062 | 42,443 | 36,140 | 39,820 |
| % | | | 0.844692 | 0.924495 | 0.764774 | | 0.520993 | 0.742481 | 0.59721 | 1.185231 |

Source: Authors, by using Eurostat (2022) [8].

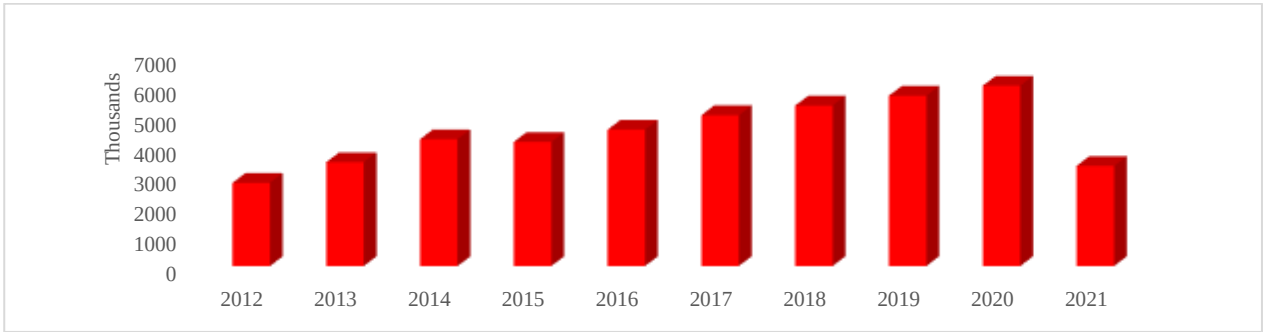


Fig. 3. Raw milk products (tons)
Source: Authors, by using Eurostat (2022) [8].

The slow development of organic agriculture in Romania, but also in other countries, is caused by the low level of interest in the market, contrary to European policies encouraging the use of domestic resources in this direction [11].

However, more and more companies operating in this field are orienting their activity towards integrating the concept of sustainability into the circular economy, from the production of raw materials to the supply of the finished food product, and the disposal of waste, be it by-products or (un)usable residues.

## 2.Public Procurement of the Food Product in Romania

The contracting authorities purchase significant quantities of food on a yearly basis to feed their own staff (such as military units' employees) or those in their care (educational establishments, social welfare centres, hospitals, etc.). For public procurement contracts above a certain value threshold, award procedures in Romania are carried out via the EPPS platform, where contract award notices concluded as a result of the negotiated procedure without prior publication (NWPP), open procedure, restricted procedure or simplified procedure are also registered.

Based on the compilation of the existing EPPS information, in the section "Agriculture and Food", between 2018 - 2022, the system generated 5,952 notices of award of food supply contracts, amounting to RON 3,766,225,506 (Table 4).

Table 4. Contract value (RON)

| Award procedure type | 2018 | 2019 | 2020 | 2021 | 2022 | Total general |
|---|---|---|---|---|---|---|
| NWPP | 33,093,142 | 44,099,737 | 44,246,424 | 69,916,858 | 186,192,896 | 377,549,057 |
| Open procedure | 37,512,184 | 363,876,887 | 323,711,957 | 432,837,916 | 1,881,262,792 | 3,039,201,735 |
| Restricted procedure | | - | - | - | 7,488,912 | 7,488,912 |
| Simplified procedure | 22,623,300 | 70,656,537 | 80,001,425 | 72,733,340 | 95,971,200 | 341,985,803 |
| **Total general** | **93,228,626** | **478,633,161** | **447,959,806** | **575,488,114** | **2,170,915,799** | **3,766,225,506** |

Source: Authors, by using EPPS [3].

The procurements from the EPPS relate only to food produced in a conventional food chain, none of the contracts had as their object the supply of organic products.

As the products purchased were diverse (dairy products, bakery products, butchery products, vegetables, fruit, oil, eggs, etc., including prepared food) and of high value, contracts were awarded mainly through open procedures (Figure 4).

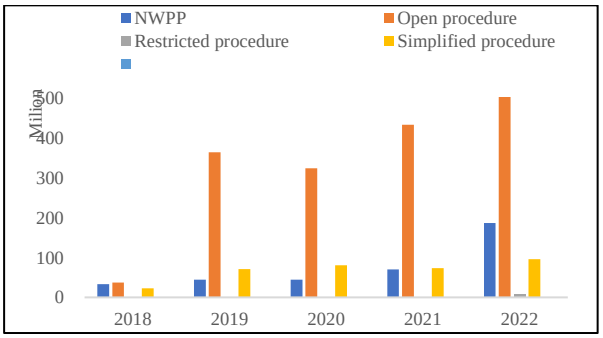


Fig. 4. Award procedure type
Source: Authors, by using EPPS [3].

The end of the pandemic in 2022 has made it possible for pre-school children, pupils and students to be physically present in educational establishments, which has led to an increase in food purchases for canteens, for the "milk-corn and apples" programme and for other hot meal programmes.

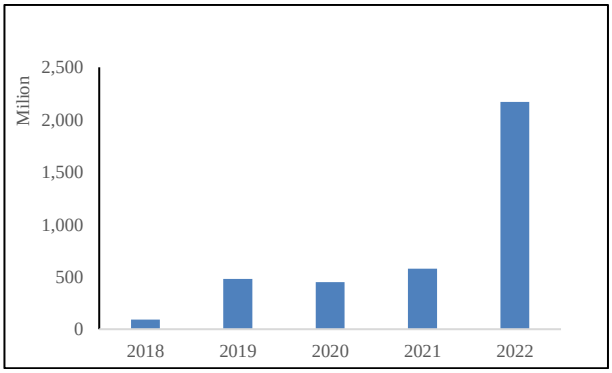


Fig. 5. Contract value (RON)
Source: Authors, by using EPPS [3].

The social care centres have also started to provide meals for people in care again. The

increase in the value of purchases in 2022, compared to previous years, is also due to the fact that contracting authorities have resorted to concluding framework agreements over a period of two to four years instead of contracts for a period of only one year (Figure 5).

Thus, the framework agreements values, recorded in the EPPS for 2022 and taken into account in this paper, do not represent the value of the food products delivered in 2022, the actual supply of which will take place in 2023-2025, depending on the duration of the framework agreement.

All this information shows the importance of public institutions in the development of the food industry, in all its aspects: obtaining raw materials, in agriculture, processing raw materials, obtaining finished products, packaging, transporting them and waste recovery/disposal.

The public procurement contracts are an opportunity for economic operators to develop, but they must have the courage to take part in the award procedures. Therefore, companies need to identify the public procurement procedures to which they can bid, adapt their business strategies to the requirements of public entities, and determine the partners with whom they can carry out such contracts, how to adapt their production of agricultural products to the constant demand of the largest and most solvent customer - the state.

With the inevitable introduction of the "farm to fork" principle by the public institutions as well, all participants in the food chain need to rethink their business strategy, with a shift towards organic food.

## 3.Public Procurement for Organic Products

The procurement of environmentally friendly products (EPP) is a challenge for contracting authorities as they do not have sufficient information about them which leads to the difficulty of drafting proper tender documentation [13].

At the same time, it is a challenge for producers/suppliers as well to take part in the public procurement procedures for organic agricultural products. Given the fact that such products are produced by small farms/ enterprises, many of them are not sufficiently familiar with the techniques of tendering to public institutions and the rigours of these types of contracts. Furthermore, the high demand for agricultural products represents a barrier for small companies to engage in large contracts such as public procurement.

In terms of EPPS implementation, the current public procurement legislation (Directive 24/2016, EU) [6] covers all the steps that need to be taken. The provisions of the Directive are transposed in Romania under Law no. 98/2016 on public procurement, with its implementing rules, GD no. 395/2016 [10].

The EPPS process, as any other public procurement, requires a rigorous planning, including the stages of: (i) planning, (ii) organising the procurement procedure, (iii) contract execution.

*I. The planning of the procurement*

The first step in initiating any acquisition is to establish the need, such as the type of food, the quantity, but also the technical specifications of the products. In the case of entities preparing food, they must, based on recipes, determine the raw material, the ingredients required and their characteristics.

*Drawing up the Necessity Report*

All this information is included in a Necessity Report, which is the primary document for any procurement. If the public institution manages to define its needs as precisely as possible, both quantitatively and qualitatively, the award procedure and the contract execution will run without a problem. Thorough planning of the procurement consists of a detailed knowledge of the need and information on what the market can provide. For example, if 500 kg of organic flour is to be acquired, the public purchaser must first establish the technical specifications of the product, which are set out in a specification/technical file annexed to the Necessity Report. In the specification, the public entity introduces the conditions for fulfilling the contract, the technical characteristics of the product (e.g. to have been obtained from a sustainable farming), the certificates that the supplier must present when delivering the product, the conditions

under which the wheat was processed, the conditions for storing the flour, the packaging and delivery method, delivery time, nutrition criteria [18].

Where authority's own canteens, the purchaser must make thorough enquiries as to the availability of the relevant market to supply all the necessary products for the preparation of menus/recipes with organic ingredients. It is not sufficient to identify the producers of organic raw materials, but their ability to deliver the required quantities within the required deadlines must also be checked/analysed. At the same time, the buyer must know/check the price of the product. Due to the limited number of organic products suppliers, it is difficult to establish the estimated contract value, a study of market being required. In the absence of all this information (appropriate technical specifications, necessary certificates, marketing conditions, products price, etc.), purchasers cannot draw up an accurate and complete tender documentation.

*Market consultation*

The identification of organic producers and processors, the determination of the necessary information for the tender documentation can be carried out either by any classical means of market research (such as analysis of specialized catalogues, websites of the economic operators, visits to sellers) or by applying a market consultation process regulated by Directive No 24/2014 (by Law No. 98/2016) [14].

Through this process, the contracting authorities are allowed to invite economic operators, independent experts, and professional organisations in order to obtain opinions, recommendations, technical, financial, contractual solutions necessary for drafting the contract award documentation. The method of establishing the products price, the qualification criteria appropriate to the procurement procedure are elements that can be clarified within this process.

In this respect, the contracting authority must publish a notice for consulting services in EPPS informing economic operators of its intention to purchase certain products for which purpose it submits some issues for consultation.

The consulting services notice must specify at least the following:

- the identification details of the purchasing public entity;
- the Internet address where information on the market consultation process can be found;
- the subject matter and description of the consultation;
- issues subject to the consultation;
- the period of time during which economic operators may communicate their proposals and suggestions;
- how the contracting authority shall interact with the companies interested in participating in the consultation process?

Conducting a market consultation process is beneficial to the purchaser, being able thus to objectively define a tender documentation through which the necessary products to be purchased. Since the number of organic raw materials producers is limited, it would be advisable to organise market consultations for any procurement procedure relating to such products in order to have a correct identification of the contracting conditions.

At the same time, the process is also beneficial to the economic operators, because at the meetings organised by the future buyer, their presence on the agro-industrial market is made known, they have the opportunity to get to know the potential competitors, and on the other hand, they find out, in advance, the intention of the public entity to purchase certain products that they can supply, as well as the contracting conditions.

Filtering the EPPS platform, for the period 01.01.2018-31.12.2022, by using the search engines "food", "vegetables", "fruit", "meat", "bread", "eggs", 282 market consultations for the purchase of various foods were generated. The contracting authorities were mainly interested in knowing the prices of the products in order to establish the estimated value of the contract, but also in the possibility of supplying large quantities of products. In some cases, economic operators were asked to submit proposals for product datasheets. In the case of organic food

procurement, due to the novelty of the contracting conditions, market consultation should become a mandatory part of the procurement process. At the end of the market consultation, the contracting authority should publish in the EPPS the outcome of the meetings with economic operators and the opinions received from them.

*Drafting the contracting strategy*

During the planning stage, the contracting authority shall also draw up the procurement strategy for any award procedure whose value is above the thresholds laid down in Art. 7(7). (5) of Law No. 98/2016.

In this document, decisions on procurement planning are recorded / finalised, such as:

(a)the estimated contract value

Given that there are few 'green' producers on the market, only in a few areas of the country, shipping costs shall be a price element that shall significantly influence the final value of the product. In establishing the estimated value of the contract, the contracting authority must also take into account other categories of expenditure, such as taxes, the cost of eco-friendly packaging, the cost of return, collection, recycling of packaging, waste generated by the supply/processing of products.

(b)qualification criteria for tenderers

These criteria are designed to "filter" economic operators so that only those who can supply products to the purchaser's required standards are allowed to compete.

The qualification criteria may refer to:

-the registration of economic operators in a professional register, such as organic farming registration;

-the ownership of environmentally friendly production capacity/equipment, use of renewable energy sources in the production of products, ownership of electric vehicles;

-the implementation of quality management standards in the production of sustainable products;

(c)the award criterion, with evaluation factors and scoring algorithm

The evaluation factors, together with the scoring algorithm, should reflect the actual advantage that the public entity shall derive from each tenderer's technical proposal and financial proposal.

The evaluation factors may include:

the position occupied by the economic operator in the supply chain [9];

- the use of recyclable/smart packaging;
- the products delivery with electric vehicles;
- the degree of collecting recyclable materials;

the packaging reduction [15].

(d)the possibility of subdividing the contract award procedure

The organic products are produced by small companies that cannot meet the high demand of the contracting authority. At the same time, the contracting authority shall find itself in the position of not having any tenderer who can supply the full quantity required. The division of the contract into lots is the solution to satisfy the need of the public authority but also for small companies to participate in the procurement procedure.

*II. Organization of the contract award procedure*

At this stage, the contracting authority publishes the tender documentation in EPPS, evaluates the tenders received and awards the contract. For the tenders' assessment, the head of the entity appoints an evaluation committee. It is very important that this committee includes people who are able to assess the conformity of the tenders, have knowledge of agri-food and organic products, so that they can assess the accuracy of the documents/information in the tenders.

Based on the qualification criteria, the tenderers who have the organisational, technical and financial capacity to execute the contract and deliver the required products are selected. After the technical and financial proposals have been assessed, the evaluation committee award points and selects the winning tender.

*III. Contract execution*

The products delivery is the final part of the procurement process. In order to monitor the fulfilment of the contract, the contracting authority appoints a contract officer who must have a thorough knowledge of the products characteristics so that he can determine

compliance with the technical specifications from the contract documents and tender.
The proper documentation and the fulfilment of the contract require trained personnel on the part of the purchaser. Both contracting authorities and economic operators must ensure that all those involved in the contracting sustainable products, from the manager to the supplier, are well trained.

## CONCLUSIONS

The demand for sustainable food is an opportunity for farmers to grow their own businesses. Public authorities, through their purchasing power and the large volumes of products they acquire, are providing incentives for economic operators to get involved in this area. At the same time, public institutions have a significant contribution to the development of sustainable agriculture and to the sustainable development objectives being implemented in the food sector.
The behaviour of contracting authorities in providing organic food is a role model, influencing people's actions in terms of nutrition and environmental protection. The state, through its policies and incentives for producers, must encourage the production of high-performance sustainable products. Contracting authorities and suppliers of sustainable products must pay attention to training the employees involved in such contracts.
The results of this article have the potential to generate future research topics such as:
(i) the challenges and obstacles for contracting authorities in drafting tender documents and managing contracts for the supply of sustainable products;
(ii) the barriers for economic operators in the supply of sustainable agricultural products;
(iii) the recycling/collection of by-products and waste from the public procurement contracts for sustainable agricultural products.

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# STUDIES ON MINIMUM WHEAT TILLING

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***Abstract***

*The development of alternative soil tillage technologies, which ensure the conservation and maintenance of its productive capacity as well as the reduction of energy consumption per unit of processed area, is today a necessity in developing a sustainable agriculture. The study presented in this paper was carried out in the area of Oravița, Caraș-Severin County, Romania, and refers to the minimum tillage technology in wheat culture. The study points to the unfavourable effect of intensive soil works – classic (conventional) system – on soil erosion. This has led to the development of some research oriented towards new technologies of soil working in the conservation system. The purpose of this paper is to promote the introduction of alternative technologies in agricultural works, by dealing with the main technical, economic and environmental aspects that compete for the achievement of efficient agriculture. From an economic point of view, this method is less expensive because fuel consumption and machine working time are reduced. The use of modern mechanization technologies has a great economic efficiency due to the following aspects.*

***Key words*****:** *economic efficiency, soil, minimum tillage, production capacity*

## INTRODUCTION

The concept of soil conservation includes a set of activities, measures and technologies that compete to maintain its state of fertility over an unlimited period [2], [3].This concept will develop in the future because soil is the most important means of human existence that ensures agri-food products, raw materials for industry, renewable energy sources; therefore, maintaining its biological capacity is a necessity imposed by the very existence of social life [14], [15]. Soil working technology represents an important way of ensuring the requirements for preserving the productive potential of the land and the evolution of their development has been dominated, at the beginning, by certain practical needs, especially of an economic nature – low energy consumption, short execution time of the works; it then forcefully met the requirements related to the concept of soil conservation [22], [24]. Soil works occupy a main place in mechanization technologies both from the point of view of its effects (loosening and aerating the soil, storing and preserving the soil, storing and preserving water in the soil, mobilizing the nutrients necessary for plants, destroying weeds, fighting diseases and pests, incorporating vegetal residues, etc.) as well as from the point of view of specific energy consumption [1], [5]. Sustainable agriculture implies that it should not only ensure an uninterrupted supply of food, but also have an accepted and recognized socio-economic impact on the environment and on human health [6], [21]. Equipping a modern and sustainable agriculture according to the experience of leading countries in this field is done with a wide range of machines and equipment, of which the machines that represent the energy basis are of great importance and economic efficiency [10]. The development of alternative soil tillage technologies, which ensure the conservation and maintenance of soil productive capacity as well as the reduction of energy consumption per unit of processed area, is

today a necessity in order to develop a sustainable agriculture [11], [18]. The conventional system is characterized by vigorous annual loosening of the soil by turning the furrow, which is then followed by other works. In relation to the intensity and frequency of soil work, three major categories of methods are distinguished within this system, namely: loosening by ploughing with furrow turning, loosening by discus and reduced loosening [12]. This system of loosening the soil also defines the type of conventional agriculture [13]. The problems that arise in order to find optimal formulas for the relationship between high productivity and a healthy environment are particularly numerous in the field of agriculture; nowadays, it is unanimously recognized that socio-economic development should change its conception in order to be less destructive from an ecological point of view; it should rely on a new concept – the global concept of sustainable development – as an imperative for continuous progress in the development of human society [9], [20]. Currently, unconventional soil tillage defines extremely varied processes – from direct sowing in uncultivated soil to deep loosening without turning the furrow [19]. Between these two extremes, there are variants such as: reduced works (classical rationalized), minimal works (with coverage under 30%), minimal works with vegetable mulch (with coverage over 30%), sowing on earth lifts, partial works or works per strips, etc. This terminology highlights the specific character that defines this procedure applied at a given time, in a certain area, and in accordance with local specifics [4], [23].

## MATERIALS AND METHODS

The study presented in this paper was carried out in the area of Oravița, Caraș-Severin County, Romania. The studies relate to the mechanization technology of minimal tillage in wheat. The mechanized works were carried out by S.C. DJ&B AGRO COMERȚ S.R.L. from Oravița. The following mechanized works were carried out: scarification, preparation of the germination bed and wheat sowing:

-The scarification work was carried out with the agricultural aggregate Challenger MT-765B tractor + Horsch Tiger 8AS scarifier.

-The germination bed preparation work was carried out with the agricultural aggregate Challenger MT-765B tractor + Swifter ST 17000 combine.

-The sowing work was carried out with the agricultural aggregate Fendt-820 Vario tractor + Horsch Pronto 6AS seeder.

Two types of tractors were used for mechanized soil works in wheat:

-the Fendt-820 Vario tractor;

-the Challenger MT-765B tractor.

The Fendt-820 Vario tractor is equipped with two gearboxes (Turboshift hydrostatic gearbox with reverse + 6-speed mechanical gearbox) and can achieve a number of 44 forward and reverse speeds (24 fast speeds + 20 slow down speeds).

Operating parameters of the tractor are as follows:

-Nominal power $N_p$ = 190 HP = 140 kW

-Nominal engine speed $n_e$ = 1,900 rpm ($\omega_m$ = 200 rad/s)

-Nominal motor torque $M_e$ = 90 daNm

-Hourly fuel consumption $G_h$ = 27.3 kg/h

-Specific fuel consumption $g_s$ = 195 g/kWh

-Weight W = 7,700 daN.

This shows that, with the increase of the load, the tractor can stop for the following reasons:

1.The tractor engine tends to stop, which means that the sum of the resistance forces exceeds the value of the tangential force, and the adhesion force with the ground has a value greater than the tangential force, i.e.:

$$F_{max} > F_{tg} < F_r + F_t \pm F_p$$

2.The tractor wheels are completely skidding so that the tractor stands still, which means that the adhesion force with the ground is less than the sum of the resistance forces of the aggregate and, at the same time, less than the tangential force, i.e.:

$$F_{tg} > F_{max} < F_r + F_t \pm F_p$$

The points of intersection between the lines of variation of the tangential force and the

maximum force of adhesion with the ground represents the limit at which:

$$F_{max} = F_{tg} = F_r + F_t \pm F_p .$$

This shows that the aggregate moves only when the adhesion condition is satisfied, i.e.:

$$F_{max} > F_{tg}$$

When the adhesion condition is not satisfied, i.e., when the tangential force is greater than the maximum adhesion force, in the operating calculations regarding the formation of aggregates, it will be considered that:

$$F_{tg} = F_{max}$$

It is observed that the adhesion force is satisfied for gears I, II, III and unsatisfied for gears IV, V and VI.

The traction forces of the Fendt-820 Vario tractor, when moving on land prepared for sowing, in forward gears are:

$$F_{t\,I;II;III} = F_{\max} - F_r = 3{,}850 - 770 = 3{,}080 \text{ daN}$$

$$F_{t\,IV} = F_{tg\,IV} - F_r = 2{,}903 - 770 = 2{,}133 \text{ daN}$$

$$F_{tV} = F_{tgV} - F_r = 1{,}910 - 770 = 1{,}140 \text{ daN}$$

$$F_{tVI} = F_{tgVI} - F_r = 1{,}375 - 770 = 605 \text{ daN}$$

The Challenger MT-765B tractor equipped with Challenger Powershift transmission achieves 16 forward speeds and 4 reverse speeds.

The operational parameters of the Challenger MT-765B tractor are:

-Nominal power $N_p$ = 320 HP = 238 kW

-Nominal engine speed $n_e$ = 2,100 rpm ($\omega_m$ = 220 rad/s)

-Nominal motor torque Me = 108 daNm

-Hourly fuel consumption Gh = 46.4 kg/h = 54 l/ha

-Specific fuel consumption gs = 195 g/kWh

-Weight W = 11,800 daN

-Drive wheel radius r = 0.762 m

-The adhesion condition is satisfied for gears I-VI and unsatisfied for gears VII-XVI.

Traction forces of the Challenger MT-765B tractor, when moving on stubble, in forward gears are:

$$F_{t1-6} = F_{\max} - F_r = 10{,}620 - 600 = 10{,}020 \text{ daN}$$

$$F_{t7} = F_{tg7} - F_r = 9{,}344 - 600 = 8{,}744 \text{ daN}$$

$$F_{t8} = F_{tg8} - F_r = 8{,}320 - 600 = 7{,}720 \text{ daN}$$

$$F_{t9} = F_{tg9} - F_r = 7{,}296 - 600 = 6{,}696 \text{ daN}$$

$$F_{t10} = F_{tg10} - F_r = 6{,}656 - 600 = 6{,}056 \text{ daN}$$

$$F_{t11} = F_{tg11} - F_r = 5{,}760 - 600 = 5{,}160 \text{ daN}$$

$$F_{t12} = F_{tg12} - F_r = 5{,}248 - 600 = 4{,}648 \text{ daN}$$

$$F_{t13} = F_{tg13} - F_r = 4{,}352 - 600 = 3{,}752 \text{ daN}$$

$$F_{t14} = F_{tg14} - F_r = 3{,}456 - 600 = 2{,}856 \text{ daN}$$

$$F_{t15} = F_{tg15} - F_r = 2{,}688 - 600 = 2{,}088 \text{ daN}$$

$$F_{t16} = F_{tg16} - F_r = 1{,}920 - 600 = 1{,}320 \text{ daN}$$

**Design of the technological scarification process**

The Horsch Tiger 8 AS scarifier is intended for loosening the soil up to a depth of 35 cm. It works in aggregate with the Challenger MT-765B crawler tractor.

The technical characteristics of the Horsch Tiger 8 AS scarifier are:

-length: 7.95 m;

-maximum working depth: 35 cm;

-mass: 7,800 kg;

-number of loosening coulters: 33 pcs.;

-working width of a coulter: 23 cm;

-number of furrow rows: 4 rows;

-distance between furrow rows: 23 cm;

-distance between coulters per row: 91 cm;

-roller tire sizes: 7.50-16;

-tire air pressure: 2.8 bar;

-pendulum traction bar;

-axle load: 5,100 kg

-drive power: 275-385 HP.

The scarified area of 100 ha has the following dimensions:

-length 1,000 m;

-width 1,000 m.

The scarifying work will be carried out by moving the aggregate according to the shuttle method. The minimum lot size should ensure work on at least one shift.

*Calculation of economic indices*

Economic indices assume both the knowledge of the consumption per area unit and of the expenses per ha, by elements of expenses [8].

*Production costs* for carrying out a mechanized agricultural work are composed of indirect costs and direct costs [7].

*Indirect costs* are costs incurred by the performance of several mechanized works or in the general interest of the enterprise. Indirect costs are recorded separately and

then, according to certain criteria, a share is allocated for each mechanized work [17].

*Direct costs* are costs that are directly determined and included in the cost of each mechanized work. In assessing the economic efficiency of an agricultural aggregate, only the indicator of direct expenses is used because it expresses the reduction of labour and material expenses by using the respective agricultural aggregate. Direct expenses are expressed in RON/ha.

**Design of the technological process for the preparation of the germination bed**

The Swifter ST 17000 combinator is intended for the preparation of the germination bed. It works in aggregate with the Challenger MT-765B tractor. The technical characteristics of the Swifter ST 17000 combiner are:

-working width: 17 m;
-transport width: 3 m;
-working depth: 5-15 cm;
-mass: 9,100 kg;
-number of loosening coulters: 166 pcs.;
-number of furrow rows: 4 rows;
-distance between furrow rows: 23 cm.

The working organs of the Swifter ST 17000 combine are: front levelling bar, four rows of active chisel-type organs, double rear roller and rear levelling bar. The active chisel-type organs for loosening can be replaced with arrow-coulter-type organs for weeding. The combiner is ideal for the preparation of the germination bed, being able to work after ploughing or after scarification, in a single pass, leaving the land ready for sowing [16].

**Design of the technological process for sowing**

The Horsch Pronto 6AS seeder is intended for row sowing of straw cereals at a distance of 15 cm between rows. It works in aggregate with the Fendt-820 Vario tractor.

The technical characteristics of the Horsch Pronto 6AS seeder are:

-working width: 6 m;
-length: 9 m;
-mass: 7,850 kg;
-number of coulters: 40 pcs.;
-type of coulters: with discs;
-distance between rows: 15 cm;
-volume of the seed box: 3,500 l

## RESULTS AND DISCUSSIONS

**Costs of mechanized works**

Exploitation and economic indices of the mechanized works of scarification, land preparation and sowing in wheat are:

***1. Calculation and formation of the aggregate to be scarified***

*Machine's resistance to scarification is:*

$R_m = K_0 \cdot a \cdot b \cdot n = 5 \cdot 10^3 \cdot 0.2 \cdot 0.23 \cdot 33 = 8{,}250$ daN,

where:

$K_0$ – soil resistance to scarification (for medium soil, $K_0 = 5 \cdot 10^3\ daN/m^2$)

$a$ – working depth ($a = 0.2\ m$)

$b$ – working width of a coulter ($b = 23\ cm$)

$n$ – number of scarifier coulters (n=33 buc)

*Working speed*

By comparing the aggregate's resistance to scarification with the traction force that the Challenger MT-765B tractor can develop, speed gear VII is chosen with which the scarification work will be carried out. The working speed will be:

$v_l = v_t(1-\delta) = 2.3(1-0.1) = 2.07\ m/s = 7.4\ km/h$

*The working capacity of the scarification aggregate*

The actual hourly working capacity is calculated with the relationship:

$W_h^r = 0.1 \cdot B_l \cdot v_l \cdot K_s = 0.1 \cdot 7.5 \cdot 7.4 \cdot 0.8 = 4.44\ ha/h$

where:

$B_l$ – working width ($B_l = 7.5\ m$)

$v_l$ – working speed ($v_l = 7.4\ km/h$)

$K_s$ – coefficient of use of working time ($K_s = 0.8$)

The actual working capacity per shift is calculated with the relationship:

$W_{sch}^r = W_h^r \cdot T_s = 4.44 \cdot 8 = 35.5\ ha/sch$

The *number of scarification aggregates* is calculated with the relationship:

$$n_a = \frac{S}{W_{sch}^r \cdot n_z \cdot n_s} = \frac{100}{35.5 \cdot 1 \cdot 3} = 0.94$$

A scarified aggregate will be used to perform the work in three days.

2. Calculation and formation of the germination bed preparation aggregate

*The tensile strength of the combiner* is:

$R_M = K \cdot B_l = 350 \cdot 17 = 5{,}950\ daN$

where:

$K$ – specific strength in daN/m;

$B_l$– working width of the combiner, in m

*Working speed*

By comparing the aggregate's resistance to the prepared ground with the traction force that the Challenger MT-765B tractor can develop, speed gear X is chosen with which the work will be carried out. The working speed will be:

$v_l = v_t(1-\delta) = 3.2 \cdot (1-0.1) = 2.9\ m/s = 10.4\ km/h$

*The working capacity of the land preparation aggregate*

The actual hourly working capacity is calculated with the relationship:

$W_h^r = 0.1 \cdot B_l \cdot v_l \cdot K_s = 0.1 \cdot 17 \cdot 10.4 \cdot 0.8 = 15\ ha/h$

The actual working capacity per shift is calculated with the relationship:

$W_{sch}^r = W_h^r \cdot T_s = 15 \cdot 8 = 120\ ha/sch$

A ground preparation aggregate will be used to perform the work in one day. The method of movement in work will be the method of movement following circular routes with 90o turns.

Calculation and formation of sowing aggregates

*The tensile strength of the seed drill* is:

$R_M = K \cdot n = 50 \cdot 40 = 2{,}000\ daN$

where:

$K$ – specific strength on the coulter in daN/m;

$n$ – number of disc coulters.

*Working speed*

By comparing the traction resistance of the seeder with the traction force that the Fendt-820 Vario tractor can develop, the fast speed gear II is chosen with which the work will be carried out. The working speed will be:

$v_l = v_t(1-\delta) = 2.7 \cdot (1-0.15) = 2.3\ m/s = 8.3\ km/h$

*Actual working capacity of the sowing aggregate*

The actual hourly working capacity is calculated with the relationship:

$W_h^r = 0.1 \cdot B_l \cdot v_l \cdot K_s = 0.1 \cdot 6 \cdot 8.3 \cdot 0.7 = 3.5\ ha/h$

The actual working capacity per shift is calculated with the relationship:

$W_{sch}^r = W_h^r \cdot T_s = 3.5 \cdot 8 = 28\ ha/sch$

A sowing aggregate will be used to carry out the work in four days. The method of movement in the work will be the shuttle method.

## CONCLUSIONS

Following the studies carried out, the following conclusions can be drawn and the following recommendations can be made: Total expenses for the minimum soil tillage in wheat, under the conditions of Oravița, were 209 RON/ha. Direct expenses in the amount of 175 RON/ha represent 80% of total expenses. Fuel expenses (117 RON/ha) represent 56% of total expenses, respectively 67% of direct expenses of the minimum tillage works. Optimal mechanization technology consists in the judicious correlation of works and agricultural aggregates during the entire technological process in order to produce with the lowest labour costs and energy consumption.

The use of modern mechanization technologies has great economic efficiency due to the following aspects:

-the works are carried out in a short period, so that optimal time for carrying out the technological work is observed;

-the number of required aggregates is reduced;

-the number of passes in the field is reduced;

-soil subsidence degree is reduced;

-fuel expenses are reduced;

-expenses with remunerations are reduced;

-significant savings per ha are obtained.

Apart from choosing the most economical option in mechanization technology, there are other important methods of reducing energy consumption: performing daily maintenance; adjusting the aggregates properly; choosing the optimal speed according to the work and terrain.

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# EVALUATION AND COMPARISON OF DROUGHT TOLERANCE IN SOME WHEAT VARIETIES BASED ON SELECTION INDICES

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***Abstract***

*Continued population growth together with current climate change will threaten global food security in the near future. Wheat is a staple cereal crop for many countries, including Romania. Therefore, to obtain high yields, it is necessary to choose wheat cultivars with drought tolerance. Research has been done out during two growing seasons: 2018-2019 and 2019-2020 in the experimental field of ARDS Simnic, the purpose of this study being the evaluation of the drought tolerance of ten wheat varieties. The obtained results confirmed the strong positive relationships between the grain yields obtained both in drought (Ys) and non-stress conditions (Ys) and STI, MPI, GMP and YI indices, these selection indices expressing a high power of discrimination between varieties at a moderate level of drought stress (SI =0.53). Based on the rank sum (RS) of all selection indices, three drought tolerant varieties were identified, namely Miranda, Simnic 60 and Glosa. These varieties can be considered as the most suitable for cultivation in the study area and other areas with similar agroclimatic conditions.*

***Key words*****:** *drought selection indices, rank sum, varieties of wheat, yield*

## INTRODUCTION

Wheat (*Triticum aestivum* L.) represents the basic food for the human population in many areas of the world, therefore it occupies a significant weight in the structure of agricultural crops. In 2021, globally, wheat was cultivated on almost 221 million hectares, with production reaching 771 million tons [10].

It is an important crop for agricultural holdings, being used for industry, food, fodder, export and as a source of profit [17]. In the Romania's external cereal trade, both in export and in import, wheat and maize occupy over 40% [19].

The current climate changes determined by the lack of precipitation and the increasing temperatures together with the worsening of the eco-environment can severely reduce the yield of crops, thus compromising the nutritional security of the growing population.

According to [6], the most severe environmental stress that limits wheat productivity is drought stress. Also, drought stress in the reproduction stage is more harmful than that in the vegetative growth stage because drought during anthesis reduces photosynthesis, grain development and ultimately grain yield.

Habitat conditions (soil, climate) and genotypes are the main factors that allow obtaining high productions with superior quality.

In the Oltenia region, drought and heat are the two major stresses with a huge impact on the growth and yields of agricultural crops [5, 7, 8, 23].

Therefore, an effective approach to reduce the harmful effects of drought stress is the use of high-yielding and drought-tolerant varieties.

Considering the complexity of the plant-environmental conditions interaction, it is obvious that each set of environmental conditions (specific to a certain area) corresponds to a certain ideotype of wheat that is endowed with those properties capable of maximizing the exploitation of local conditions [20].

Based on the genotypic response to culture conditions, [12] established 4 Groups of genotypes:

- Group A: genotypes that achieve uniform performance in both conditions (stress and non-stress), having both high productivity and tolerance to stress;
- Group B: genotypes that show performance only in non-stress conditions, so they have no stress tolerance and achieve high productivity only in non-stress conditions;
- Group C: the genotypes that express performance only under stress conditions, they have tolerance to stress, but a low productivity;
- Group D: genotypes expressing a poor performance in both conditions. These genotypes have low productivity and low tolerance.

According to [24], for the comparison of changes in grain yields and the identification of genotypes from group A, various selection indices can be successfully used that are based on the mathematical relationship between yields under stress and non-stress conditions. The most used selection indices in many previous studies were GMP and STI [12], SSI [13], TOL and MPI [21] ], YI [14], and DRI [16].

Also, moderate drought-stress environments are considered more suitable for selecting drought-tolerant genotypes than severe drought-stress environments [1].

The objectives of present study were to evaluate and compare grain yields based on selection indices, and to identify the most stable high-yielding varieties under both non-stress and drought conditions.

## MATERIALS AND METHODS

This study was carried out in the experimental field, in two contrasting growing periods (2018-2019 and 2019-2020) at Agricultural Research and Development Station Șimnic, located 4 km North from Craiova. The 2018-2019 growing period was characterized as dry, with insufficient precipitation (429.5 mm) and an average temperature of 13.3°C. The period 2019-2020 was optimal for the wheat crop, summing up a total amount of precipitation 451.4 mm and an average annual temperature of 11.8°C (Table 1).

Trials were carried out on 10 wheat varieties in a randomized block with three repetitions. The soil in the experimental field was reddish preluvosol with a humus content of 1.8% and a pH=5.7-6.9.

To evaluate drought tolerance, seven selection indices were used: the index for stress susceptibility - SSI [13], index for stress tolerance - STI [12], index for mean productivity - MPI [21], index for geometric mean productivity - GMP [12], index for tolerance - TOL [21], index for yield - YI [14] and index for drought resistance - DRI [16].

These indices were calculated according to the following formulas:

$$SSI = [1 - (Ys/Yp)]/SI;\ SI = 1 - (Ysi/Ypi)$$

$$STI = (Yp) * (Ys)/(Ypi)^2$$

$$MPI = (Ys + Yp)/2$$

$$GMP = \sqrt{Ys * Yp}$$

$$TOL = (Yp - Ys)$$

$$YI = Ys/Ysi$$

$$DRI = Ys * (Ys/Yp)/Ysi$$

Yp and Ys are the grain yields obtained by each variety under non-stress and drought conditions (t/ha), and Ypi and Ysi are the average yields for all varieties under non-stress and drought conditions.

The rank sum (RS) for all the indices used was calculated with the formula below [11]:

$$RS = R + SDR$$

SDR is the standard deviation of rank, and R is the rank average;

The following statistical parameters were determined: average, standard deviation of the average and correlation coefficients using MS EXCEL program.

## RESULTS AND DISCUSSIONS

### *Performance of varieties*

Average grain yields and mean values of drought indices of the 10 varieties under non-stress (Yp) and drought conditions (Ys) were presented in Table 2.

The lower yields obtained in 2019 are due to the effect of the lack of precipitation in

October and the insufficient precipitation in May, months that coincided with the germination and anthesis phenophases, but also the higher average temperatures this year that amplified the effect of the drought.

The average yields under optimal conditions (non-stress) was 7.20 t/ha, and the 7 varieties that had higher yields than this average were considered varieties with high potential yield. In drought conditions, the average yields was 3.41 t/ha, and 5 varieties had higher yields than this average. The Pajura variety (8.17 t/ha) followed by the Simnic 60 variety (7.64 t/ha) recorded the highest grain yield values under non-stressed conditions, and the Miranda variety (3.85 t/ha) followed by the Otilia (3.68 t/ha) recorded the higher grain yield values under drought conditions.

Table 1. Monthly precipitation and average temperatures at ARDS Şimnic

| **Parameters** | **Years** | **Oct.** | **Nov.** | **Dec.** | **Jan.** | **Feb.** | **Mar.** | **Apr.** | **May** | **Jun.** | **Jul.** | **Total Oct.-Sept.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Precipitation (mm) | 2018-2019 | 0 | 51 | 37 | 39.5 | 8.4 | 24 | 42 | 32 | 136 | 59 | 437.9 |
| | 2019-2020 | 32.8 | 46.4 | 4.8 | 23.6 | 20.6 | 64.6 | 4.5 | 71 | 71 | 90 | 451.4 |
| Temperatures (°C) | 2018-2019 | 14.3 | 5.5 | -0.3 | -1 | 4.1 | 11 | 11.9 | 16.2 | 22.7 | 22.9 | 13.8 |
| | 2019-2020 | 14.3 | 9.8 | 1.5 | 6.1 | 3.9 | 7.8 | 12 | 16.2 | 21.3 | 23.2 | 11.8 |

Source: Craiova meteorological station.

In non-stressed conditions, Bezostaia (5.58 t/ha) followed by Izvor (6.99 t/ha) recorded the lowest grain yield values, and in drought conditions, varieties Bezostaia (2.86 t/ha) and Ursita (3.20 t/ha) recorded the lowest values (Table 2). This variation of grain yields under drought (Ys) and non-stress (Yp) conditions suggested the existence of important genetic resources for obtaining drought-tolerant genotypes, confirming the results found by [9].

### *Comparison of cultivars based on tolerance indices*

According to [22], under a moderate stress, the STI, MPI and GMP indices are more able to distinguish Group A genotypes (with high productivity and stress tolerance) from other groups. Therefore, high values for these indices express the higher drought tolerance and higher yield potential of the varieties.

Table 2. Average grain yields under non-stress (Yp) and drought conditions (Ys) with stress tolerance indices (SI =0.53)

| **Variety** | **Yp** | **Ys** | **STI** | **SSI** | **MPI** | **GMP** | **TOL** | **YI** | **DRI** |
|---|---|---|---|---|---|---|---|---|---|
| Simnic 60 | 7.64 | 3.60 | 0.53 | 1.00 | 5.62 | 5.24 | 4.04 | 1.05 | 0.50 |
| Adelina | 7.40 | 3.29 | 0.46 | 1.05 | 5.35 | 4.93 | 4.11 | 0.96 | 0.43 |
| Ursita | 7.39 | 3.20 | 0.45 | 1.07 | 5.29 | 4.86 | 4.19 | 0.93 | 0.41 |
| Pitar | 7.33 | 3.36 | 0.47 | 1.02 | 5.34 | 4.96 | 3.97 | 0.98 | 0.45 |
| Pajura | 8.17 | 3.53 | 0.55 | 1.07 | 5.85 | 5.37 | 4.64 | 1.03 | 0.45 |
| Otilia | 7.00 | 3.68 | 0.50 | 0.90 | 5.34 | 5.08 | 3.32 | 1.07 | 0.57 |
| Glosa | 7.25 | 3.55 | 0.49 | 0.98 | 5.40 | 5.07 | 3.70 | 1.04 | 0.51 |
| Izvor | 6.99 | 3.21 | 0.43 | 1.02 | 5.10 | 4.74 | 3.78 | 0.94 | 0.43 |
| Bezostaia | 5.58 | 2.86 | 0.30 | 0.92 | 4.22 | 3.99 | 2.72 | 0.83 | 0.43 |
| Miranda | 7.25 | 3.85 | 0.54 | 0.88 | 5.55 | 5.28 | 3.40 | 1.12 | 0.60 |
| Average | 7.20 | 3.41 | 0.47 | 0.99 | 5.31 | 4.95 | 3.79 | 1.00 | 0.48 |

STI is the index for stress tolerance ; SSI is the index for stress susceptibility; TOL is the index for tolerance; MPI is the index for mean productivity; GMP is the index for geometric mean productivity; YI is the index for yield; DRI is the index for drought resistance

Source: Own calculation based on the experimental data obtained.

In our study, the Pajura, Miranda, Simnic 60, Otilia and Glosa varieties had the highest ITS value indicating that these could be the most suitable varieties (Tables 2 and 3).

The best varieties based on MPI index were Pajura, Simnic 60, Miranda, Glosa, Adelina, Pitar and Otilia, and the best varieties based on GMP were Pajura, Miranda, Simnic 60, Otilia, Glosa and Pitar.

According to YI, varieties Miranda, Otilia, Simnic 60, Pajura, - and by DRI, varieties Miranda, Otilia, Glosa, Simnic 60 - were the most suitable varieties (Table 3).

Low values of SSI and TOL indices indicate greater tolerance to drought [18].

Thus, the varieties Bezostaia, Otila, Miranda, Glosa and Izvor had the lowest values by the TOL index, and the varieties Miranda, Otilia, Bezostaia and Glosa had the lowest values by the SSI index (Tables 2 and 3).

Therefore, there were variations in the ranking of varieties according to different indices.

***Ranking of varieties***

Due to the lack of consistency of the indices used in their ability to identify the most suitable and drought tolerant wheat varieties, mean rank, standard deviation of ranks and rank sum were calculated for the ranking of these varieties (Table 3). Some previous studies by [2, 4, 11], successfully used this ranking method for drought tolerance screening.

Table 3. Ranks (R), standard deviation of ranks (SDR) and ranks sum (RS) of selection indices

| Variety | Yp | Ys | STI | SSI | MPI | GMP | TOL | YI | DRI | R | SDR | RS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Simnic 60 | 2 | 3 | 3 | 5 | 2 | 3 | 7 | 3 | 4 | 3.56 | 1.59 | 5.15 |
| Adelina | 3 | 7 | 7 | 8 | 5 | 7 | 8 | 7 | 9 | 6.78 | 1.79 | 8.57 |
| Ursita | 4 | 9 | 8 | 9 | 8 | 8 | 9 | 9 | 10 | 8.22 | 1.72 | 9.94 |
| Pitar | 5 | 6 | 6 | 7 | 6 | 6 | 6 | 6 | 5 | 5.89 | 0.60 | 6.49 |
| Pajura | 1 | 5 | 2 | 10 | 1 | 1 | 10 | 5 | 6 | 4.56 | 3.64 | 8.20 |
| Otilia | 8 | 2 | 4 | 2 | 7 | 4 | 2 | 2 | 2 | 3.67 | 2.35 | 6.01 |
| Glosa | 6 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 3 | 4.33 | 0.87 | 5.20 |
| Izvor | 9 | 8 | 9 | 6 | 9 | 9 | 5 | 8 | 7 | 7.78 | 1.48 | 9.26 |
| Bezostaia | 10 | 10 | 10 | 3 | 10 | 10 | 1 | 10 | 8 | 8.00 | 3.50 | 11.50 |
| Miranda | 7 | 1 | 1 | 1 | 3 | 2 | 3 | 1 | 1 | 2.22 | 1.99 | 4.21 |

STI is the index for stress tolerance ; SSI is the index for stress susceptibility; TOL is the index for tolerance; MPI is the index for mean productivity; GMP is the index for geometric mean productivity; YI is the index for yield; DRI is the index for drought resistance

Source: Own calculation.

According to the ranking method, the lowest ranks sum were recorded for the wheat varieties Miranda (RS=4.21), Simnic 60 (RS=5.15), and Glosa (RS=5.20), therefore these varieties were found to be the most tolerant to drought, while the highest ranks sum were recorded for the Bezostaia varieties (RS=11.50). ), Ursita (RS=9.94), and Izvor (RS=9.26), these being the most sensitive to drought (Table 3).

***Correlations of grain yield and selection indices***

Selection criteria capable of distinguishing genotypes from group A from other genotypes are considered to be the most effective [12]. Among these, the most suitable selection indices are those that achieve a high correlation with grain yields obtained in both environments [2, 22].

In our study, under a moderate drought level (SI=0.53), Yp was significantly positively correlated with Ys (r=0.608) (Table 4).

This correlation between Yp and Ys is an indication that the high yield performance under non-stressed conditions led to a relatively high yield under drought conditions. Similar results were reported by [18].

The significant positive correlations were found between Yp and STI, MPI, GMP, TOL, YI, also between Ys and STI, MPI, GMP, YI, DRI (Table 4). Therefore STI, MPI, GMP and YI indices are able to distinguish Group A varieties from other varieties. Similar results reported by [3]. The correlation of TOL with

Ys (r=0.214) was positive and non-significant, but the correlation with Yp was significantly positive (r=0.906). As a result, varieties selection based on the TOL index will lead to a significant yield reduction under non-stress conditions [25].

Table 4. Correlation coefficients between yields in non-stress (Yp) and drought conditions (Ys) and selection indices

| Index | Yp | Ys | STI | SSI | MPI | GMP | TOL | YI | DRI |
|---|---|---|---|---|---|---|---|---|---|
| Yp | 1 | | | | | | | | |
| Ys | 0.608* | 1 | | | | | | | |
| STI | 0.883** | 0.908** | 1 | | | | | | |
| SSI | 0.561 | -0.310ns | 0.108ns | 1 | | | | | |
| MPI | 0.965** | 0.796** | 0.975** | 0.325ns | 1 | | | | |
| GMP | 0.907** | 0.886** | 0.997** | 0.164ns | 0.986** | 1 | | | |
| TOL | 0.906** | 0.214ns | 0.602* | 0.855** | 0.762** | 0.643* | 1 | | |
| YI | 0.618* | 0.999** | 0.912** | -0.294ns | 0.804** | 0.892** | 0.228ns | 1 | |
| DRI | 0.087ns | 0.843** | 0.542ns | -0.770$^{00}$ | 0.346ns | 0.497ns | -0.343ns | 0.833** | 1 |

*, ** - significant positive at probability level of 5% and 1%, respectively; $^{00}$ - significant negative at probability level of 1%; ns - non-significant;
STI is the index for stress tolerance ; SSI is the index for stress susceptibility; TOL is the index for tolerance; MPI is the index for mean productivity; GMP is the index for geometric mean productivity; YI is the index for yield; DRI is the index for drought resistance
Source: Own calculation.

The close correlation (r=0.999) between the YI and Ys indices indicates that these two indices are identical in varieties ranking.
Positive and significant correlations were also observed between YI and STI, MPI, GMP (Table 4). Similar results were found in a previous study [15].

## CONCLUSIONS

The assessment of drought tolerance in different rainfed environments allows the ranking of varieties according to their performance in each environment (with stress or non-stress). To identify drought-tolerant wheat varieties under moderate drought conditions, it is recommended to use the STI, MPI, GMP, YI indices because these indices support a stable and high yield both under non-stress and drought conditions. The screening of drought tolerant varieties by the ranking method for all selection indices used identified the varieties Miranda, Simnic 60 and Glosa as the most droughts tolerant and suitable varieties for cultivation in the agro-climatic conditions of the study area.

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# CONCEPTUAL MODELS, BARRIERS AND OPPORTUNITIES FOR ADOPTION AND DIFFUSION OF AGRICULTURAL INNOVATIONS

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***Abstract***

*Agricultural innovations are considered a key driver in overcoming the global challenges related to climate change, natural resources scarcity and food security. However, the features of agriculture increase the degree of complexity in the implementation and adoption of the innovations. The aim of the study is to observe the theoretical and empirical literature on agricultural innovations adoption and diffusion and to outline the main conceptual models, barriers and opportunities in these processes. The study results show that there has been diversity in research linked to agricultural innovations adoption methods and models and therefore lack of globally accepted methodology. The surveys in the field represent different perspectives and outline social, economic and marketing points of view in the innovation diffusion system, which highlight the major challenges and prospects. The broader acceptance of agricultural innovations requires interaction and linkages between different stakeholders, knowledge transfer and the active role of the institutional setting in shaping the processes critical for agricultural innovation adoption.*

***Key words*****:** *drivers of adoption, agricultural innovation system, knowledge transfer*

## INTRODUCTION

Agricultural innovations are considered a key driver in overcoming the global challenges related to climate change, natural resources scarcity and food security. Agricultural innovations are a multi-disciplinary scientific and research field [15, 28, 43] that is related to sustainability, smart agriculture and social welfare. Agricultural innovations could lead to new paths and ideas that address emerging issues and increase the efficiency of products and services. [44, 51]. The diffusion of agricultural innovations is a complex and dynamic process that requires a multifaceted approach that takes into account the social, cultural, economic, and environmental dimensions of agriculture. By understanding and addressing the factors that influence the adoption and implementation of new ideas and practices, sustainable and inclusive agricultural development that benefits farmers, communities, and the environment could be promoted. The aim of the study is to observe the theoretical and empirical literature on agricultural innovations adoption and diffusion and to outline the main conceptual models, barriers and opportunities in these processes. The paper is structured as follows: First, the methodological framework is presented. In the second part, the study observes the evolution of the agricultural innovation process that leads to change in adoption and diffusion. The main models, barriers and drivers in the process are also outlined. Based on the survey conclusions and recommendations are highlighted.

## MATERIALS AND METHODS

The survey is based on the methodological framework presented by De Alcantara et al. [13]. The methodology of their survey applies discourse analysis. This approach includes observation of literature (papers, reports, articles) on the topic in order to understand different models and interactions between actors to create new technologies [37]. In addition, a systematic literature review is conducted by applying methods proposed by [46].

## RESULTS AND DISCUSSIONS

Innovations are a key factor in improving productivity and competitiveness and play an

essential role in creating employment and generating income. FAO [18] defines agricultural innovation as a process „ when individuals and groups adopt new ideas, technologies or processes that, when successful, spread through communities and societies. The process is complex, involving many actors, and it cannot function in a vacuum". In the last decades have been significant changes in farming patterns in Europe. While part of the agricultural holdings continues with traditional approaches related to increasing productivity, new methods in agriculture are developing and evolving. Due to limited resources in agriculture and strong dependence on natural factors, farmers have to adopt innovations related to new machines, processes and techniques and new business and management models. Innovations in the agricultural sector are the result of the interaction between different stakeholders in the sector.

Table 1. Approaches to agricultural innovation

| **Approach** | Technology-oriented approach | System-oriented approach | | |
|---|---|---|---|---|
| | | Farming system | AKIS | AIS |
| Period | 1950-1980 | 1980-1990 | 1990-2000 | XXI century |
| Aim | Invention, diffusion and adoption of new technologies in order to increase productivity | Based on R&D adoption of new technology in order to improve farmers` welfare | Focus on local capacities for adoption in order to empower farmers and integrate different types of knowledge for sustainable development | Increase the capacity of diffusion in order to to provoke institutional change |
| Main features | New technologies Technology transfer and efficiency | Adaptation to local conditions, knowledge transfer | Joint knowledge transfer and learning Value chain approach | Identification of the main stakeholders` Analysis and adaptation to the institutional environment |
| Innovation flow | Top-down | Top-down | Bottom-up | Multi-directional |
| Channels for adoption and diffusion | Extension of new technology Key role of mass media to facilitate adoption | Consultation in order to improve the speed of adoption Surveys to identify farmers` needs and models Theof adoption and diffusion | Joint knowledge and learning in order to improve adoption and diffusion | Development and implementation of multi-actor innovation platforms |
| Role of the farmers | Adopters of technologies | Adopters of knowledge and technologies Key role in the information process | Experimenter in the innovation and diffusion process | Active role as partners in the innovation and diffusion Part of innovation network |
| R&D | Develops technology and knowledge | Advises and experiments | Develop capacity for adoption Main role in knowledge transfer | Key role in innovation capacity improvement Part of the innovation network |

Source: [30, 46, 58].

According to World Bank [59], innovation often results from collective action,

coordination and knowledge exchange between different stakeholders.

It should be noted that the concept of innovation in agriculture has evolved in recent years. It is no longer defined only as the adoption of new technologies. According to Sonnino and Ruanne [50], "it is more a successful combination of technologies and practices, new knowledge, institutions and forms of social organization".

In scientific literature it can be pointed out that there is an evolution from technology to system-oriented views in the analysis of the innovation process.

Klerkx et al. [30] outlines four approaches related to the development of the concept for agricultural innovation. (Table 1).

The technology-based approach is associated with a process in which the basic idea created by scientists and different researchers is presented and directed to the farm managers. [43] The minor role of farmers is considered a main weakness of the approach and leads to the development of more systems-oriented approaches [20]. The farming System is an important step toward the acknowledgment of farm manager role and position in the innovation process. However, the lack of acknowledgement of the influence of other drivers for agricultural innovations is the main weakness of the approach [21]. Therefore, a shift from top-down to bottom-up approaches to agricultural innovation was established, which evolved into the Agricultural Knowledge and Information Systems (AKIS) approach [17]. This development is linked to joint learning and interaction between researchers, farmers and other value chain actors as an important step for sustainable agricultural development [31].On the other hand, the AKIS approach has a mainly local focus and does not take into account the multi-level links between stakeholders. The approach does not consider as important the unequal role of the stakeholder and poses challenges for innovation implementation.

Therefore, the agricultural innovations system (AIS) approach includes new aspects of innovation related to the political and institutional environment [24]. Some studies highlight the important coordination between actors and institutions in agriculture [23, 29, and 45].

According to Peterson, and Horton [40], adapting and implementing innovations is a long process. As an important step, diffusion has been analyzed and is an object of different discussions. [27, 51]. Diffusion can be defined as the "spreading of new ideas, structures, and practices" [12]. Social science considers two key opinions in diffusion process definitions- "rational accounts" and "social accounts" of [5, 51]. "Rational accounts" of the process are related to the economic aspect of diffusion and are associated with the implemented innovation's costs, benefits and efficiency [41, 43, and 52].

"Social accounts" of diffusion have different focus and are linked mainly to sociology. This perspective analyses the pressure to adapt to society. Based on the institutional theory [47, 53], social accounts of diffusion follow how the effect of the group behavior can replace rationality. Social effects may cause the adoption and diffusion of innovation that are inefficient for individual farmers. [2, 52].

The main limitation of these two perspectives is related to understanding the diffusion of innovation as a reaction to a certain pressure or impact. [38]. On the other hand, in order to find solutions for global challenges, the implementation of innovations and expansion of new ideas need an active role of stakeholders active in the process rather than passive adoption.

In agriculture, few important studies define the main theories, models and methods that affect the adoption and diffusion studies [4, 7, 22, and 43]. These surveys are based on different aspects of social science- economics, sociology, marketing, and psychology.

Rogers [43] defined the diffusion process and focuses on the interaction among social system members. The author survey analyses the main factors influencing adoption: relative advantage, compatibility, complexity, trialability, and observability.

On the other hand, Griliches [22] highlighted profit advantage as the main factor for the diffusion of agricultural innovation. Bass applies the marketing model to define the adoption rate and speed [39]. The theory of

Planned Behavior [4] has been considered important for understanding the individual decision-making process and the influence of external factors, norms, and motives.

Young[60] and Montes de Oca Munguia et al.[36] adapted the different perspectives from social sciences in the agricultural sector. Based on surveys of [36, 60], three critical models of the diffusion of agricultural innovation can be outlined. Some surveys show that the adoption process needs to be understood from a multidisciplinary perspective. [49, 60]

The abovementioned studies highlight the main aspects and paths of agricultural innovation adoption and diffusion models (Figure 1).

The economic aspect focuses on profit and outcome. In the social path, adoption is influenced by social group behavior. In contrast, in marketing-based studies, the adoption and diffusion are linked to the connections and are affected by mass communication.

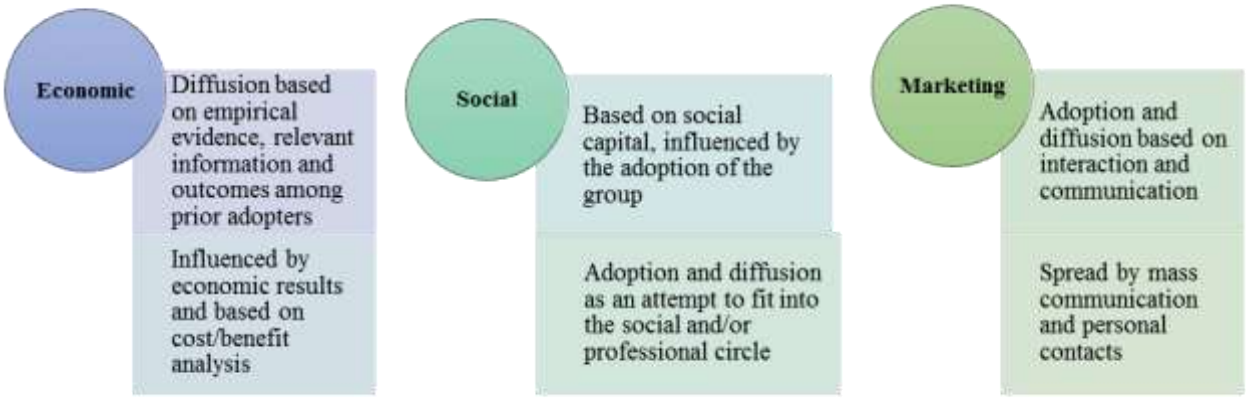


Fig. 1. Paths and aspects of agricultural innovation adoption and diffusion models
Source: Own research based on [36, 60].

The survey [36] analyses the main agricultural adoption and diffusion models based on the literature review. According authoress's survey findings, most of the analyzed adoption conceptual models in agriculture consider adoption a staged process [32, 41]. The main steps towards diffusion are related to a process of learning and experimentation. Rogers [43] includes five stages of the innovation's implementation process: "knowledge, persuasion, decision, implementation, and conformation". In addition, Adrian [3] analyses innovations in precision agriculture and adapted a model that presents and observes how a farmer understands, accepts and implements different new practices and technologies.

Lindner et al. [32], on the other hand, highlighted that the diffusion process has a time lag from the availability of agricultural innovation to the individual decision for adoption. Lindner et al. [32], point out that information plays a crucial role in the diffusion process.

Abadi Ghadim and Pannell [1], present a model that outlines farmers' personal perception and management skills as the main factors for the diffusion of agricultural innovation. Their model considers adoption as a rational economic decision with the objective of profit maximization [1].

The abovementioned models based on rational choice are often criticized for not taking into account social and psychological factors that can influence the adoption process, alongside the social norms and attitude of the social group. [56].

The Theory of Planned Behavior [4] is the main psychological decision-making model. The theory observes the relationship between attitudes and intentions to explain behavior. The theory is combined with other relevant theories [42] to explain farmers' decision to adopt agricultural innovation. However, the majority of studies in agriculture are not dominated by one particular theory [54, 55]

Based on analyzed models, it can be concluded that there are diverse perspectives on the adoption and diffusion in agriculture. This variety can be explained with the application of different theories which have origins in different disciplines.

Economic indicators such as profit, environmental and risk advantages are considered as main factors for adoption, especially in technological innovation. In addition, decision-making is also information-driven. The role of farmer skills and practice awareness influence the processes. From the social and psychological point of view, the role of the group and advisers is the main driver for adoption and diffusion.

On the other hand, important features of the adoption and diffusion processes are related to learning and practice. Johnson et al. [26] observe the relationship between adopters before and after adoption. In agriculture, this also refers to the relationship between farmers and innovation and also between farmers and the companies selling and servicing the new technology.

It should be noted that external factors influence the decision-making process of adoption. However, some studies argue that diffusion remains an individual process [36].

Generally, a group of factors could be highlighted as drivers or limitations for agricultural innovation adoption and diffusion.

Based on the literature review [10, 33, 34], observe the barriers to agricultural innovation adoption, diffusion and scaling. The studies of [10, 33] divide the limitation into two main groups: external and internal.

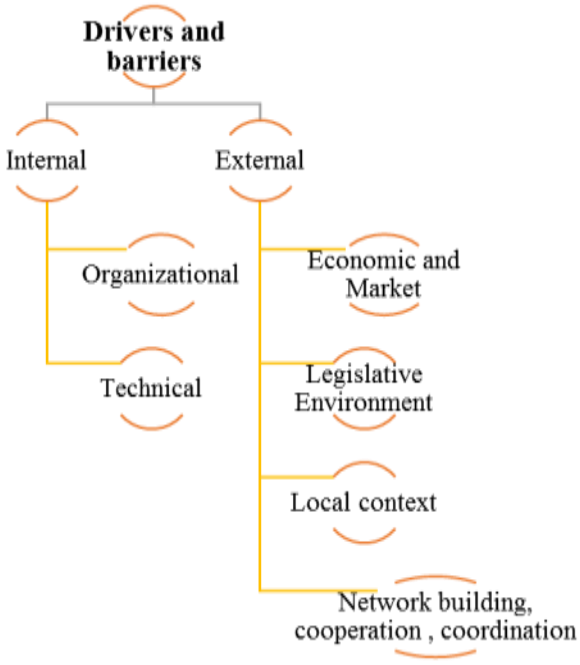


Fig. 2. Drivers and barriers for agricultural innovation diffusion
Source: Own research based on [10, 14, 33].

As an external factor, legislative and institutional environment and government support could boost agricultural diffusion. However, low institutional support or lack of regulatory framework, alongside bureaucracy, can hinder the innovation and diffusion process [8, 19, 35]. Institutional settings play a central part and link different stakeholders and innovation flows [23].

Economic factors are an important part of the diffusion process. High initial investments, access to capital and a long pay-back period, and high implementation costs can be serious barriers [8, 9, 11].

Concerning the economic limitation the consumer behavior and lack of attractiveness, market uncertainty can delay or prevent the adoption and implementation of innovation.[8, 9, 35].

Adapting to the local context is an important part of the diffusion of innovation. The process could meet several challenges when the new practice or project does not consider the local specifics [11, 16, 25, 49, 57].

Knowledge transfer, networks and better coordination among actors, and dissemination could be an opportunity but, at the same time, also a barrier to innovations adoption and diffusion [6, 10, 48,].

These knowledge-sharing and learning processes are interactive and require linkages with different knowledge bases. The new technologies often are related to new links, actors and roles.

Internal factors include the inability to assess technologies and the lack of required competencies as technical limitations in the process [11]. Organizational factors such as management skills and leadership are crucial in implementing new technologies. Risk preferences and disposition could also be considered a barrier or a driver.

Human resources skills, training and capacity, are also important in the diffusion process.

The process of innovation diffusion requires the legislative environment, cooperation with a broader range of stakeholders and financial resources. Furthermore, adoption and diffusion could lead to a number of changes in external and internal environment, network and coordination, management skills and leadership models.

## CONCLUSIONS

Based on the survey, it can be concluded that the agricultural innovation process reshaped and evolved from a technology-based perceptive to a system-based approach. The diffusion process also can be influenced by various factors and seen in different aspects.

One of the key challenges of agricultural innovation diffusion in a global context is ensuring that the new ideas are relevant to the community's local context and needs. This requires an understanding of the cultural, economic, and environmental factors that shape the local farming practices, as well as the priorities of the farmers.

The implementation and diffusion of agricultural innovations are linked to a number of factors that influence the speed of the process. The infrastructure and access to production factors are essential for farmers to adopt innovation practices. Other drivers in this regard are the markets and finance availability, but also national policy, government priorities and strategic plans. The institutional and political dimensions are crucial in supporting innovation and entrepreneurship in the agriculture.

It can be summarized that the diffusion of innovations requires serious investment, coordination, cooperation and network building in order to boost productivity, sustainability, circularity and competitiveness.

The diffusion of agricultural innovations is a dynamic process that requires multidimensional links between stakeholders and should consider the sustainable development goals and agricultural transformation toward green growth.

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# GREEN PUBLIC PROCUREMENT AS A CIRCULAR ECONOMY POLICY

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***Abstract***

*Promoting the circular economy (CE) is a fundamental prerequisite of the proposed `European Green Deal` and the transition to the CE is a strategic objective of the European Union. Cohesion policy and other established public policies are taking a new approach, being adapted to the requirements of sustainable development. This research aims to highlight that green public procurement in combination with circular procurement is an effective tool through which public authorities can stimulate the circular economy transition. The methodology is based on the literature review, outcomes from the own previous research, the processing for analysis of data with tables and graphs, and the analysis and synthesis of recent strategic documents from the EU and Romania. The conclusions and recommendations refer to the premises and prospects of green public procurement for the promotion of the circular economy, also with reference to the agro-industrial field as a priority sector.*

***Key words*****:** *circular economy, green, policy, public procurement, intermediate consumption*

## INTRODUCTION

Circular Economy (CE) is an innovative paradigm that means a revival of the economy and environment by prolonging the active and useful life of products and resources.

Circular economy is in a synergistic relationship with sustainable development, and the transition towards a circular economy is one of the main EU policies to help Europe meet its commitments under the UN Sustainable Development Goals (SDGs). It can be argued that many of the 17 targets are directly or indirectly affected by the circular economy, although apparently the most directly affected is SDG12, which aims to ensure sustainable consumption and production models [17].

In essence, the CE aims to decouple economic activity from the consumption of natural resources, while at the same time eliminating negative externalities, such as waste and pollution, from the system. An important insight is that, although intuitively, green environmental protection policies and regulations that are intended to internalize or mitigate negative externalities can contribute to progress for the transition to the circular economy, in reality this process has proved more difficult and less well accepted by the society and stakeholders.

That is why, since 2015, through the first action plan for the EC, but especially through the new Circular Economy Action Plan in 2020, the European Commission has stated that special, concerted and coordinated strategic, legal, institutional and political steps are needed in order to implement the circular economy at all levels (community, national, regional, local) [12].

The European Green Deal (EC COM (2019) 640 final) [6] also sets out the transition to the circular economy as a related objective, and the latest CE Action Plan (COM (2020) 98 final) includes a section on 'economic justification', which suggests and supports the wider application of fiscal or non-fiscal policies and instruments, such as environmental taxation (including waste taxes), elimination of subsidies for non-renewable resources, application of special grants, circular public procurement.

This paper will exemplify some of these policies and strategies aimed at promoting the circular economy, as they have already been adopted and implemented in some EU member states.
A particular attention will be paid to green public procurement to analyse how this instrument can contribute to the CE and its degree of implementation in the EU. The premises and perspectives in Romania are analysed finally.

## MATERIALS AND METHODS

The objective of this research paper is to identify how public policies influence the circular economy CE at EU level and in Romania.
The research hypothesis is these policies, and in particular green public procurement, may significantly impact on the transition to the circular economy of national economies in the European Union, if properly designed and addressed.
The methodology is based on the following main procedures:
-literature review on the public policies adequate for a circular economy;
-outcomes from the own previous research;
-the processing for analysis of data with tables and graphs, for indicators of the government policies such as the Intermediate Consumption of the General Government (ICGG), as well as of the circularity of some EU countries, including Romania, measured by the synthetic indicator Circular Material Use Rate (CMUR):
-the analysis and synthesis of recent strategic documents from the EU and Romania regarding the role of the green and circular public procurement in promoting the circular economy.

## RESULTS AND DISCUSSIONS

### Conceptual background

The basic elements of CE are: reducing the total consumption of materials; product reuse by extending product life through repair, refurbishing; recycling; recovery of materials in production and use processes.
In addition, circular economy is operationalized on multiple levels: at the micro level (products, companies, customers), at the meso level (eco-industrial parks, economic sectors) and at the macro level (region, nation) (Ghisellini et al, 2016; Kirchherr et al, 2017) [18, 20].
In order to achieve the transformation from a linear to a circular system, some practices and solutions from different stages of the value chain are taken into account, accomplished by:
-Closing the loops of materials, which can be achieved by replacing raw materials or new products with secondary materials and second-hand products or parts, repaired or reconditioned;
-Slowing down material flows by extending the service life of products through better design, maintenance and repairs;
-Reduced material flows by using fewer resources per product or using fewer products to provide the same service to society.
It is generally considered that the focus has been more on direct administrative interventions, supported by policy and informational tools, while the potential of financial and economic instruments for a CE has not been fully employed yet (Hartley K, van Santen R, Kirchherr J, 2020) [19].
Similarly, recent rigorous research approaching the public policies and business models suitable for the circular economy (Wasserbaur et al, 2022; Platon et al, 2022, Platon et al, 2023; Constantinescu et al, 2022) [31, 26, 27, 5] confirmed the significance of these policy areas and highlighted new areas such as circular eco-innovation.

In the EU, the importance of public procurement has increased in the last about 20 years, as a policy for stimulating demand and eco-innovation (Edler and Georghiou, 2007) [7]. These public acquisitions may impact on the resource productivity and economic efficiency in the economy, mainly by the specific criteria used (Bratt et al. 2013) [6].

In order to promote the sustainable development objectives, the concept of Green Public Procurement (GPP) was introduced in the EU, as the process used by public

authorities to buy goods or services with a lower environmental impact (of their life cycle) as compared to other similar functionality goods and works to be procured. (COM (2008) 400) [4].

The GPP is welcome but nowadays the transition to a green, circular economy demands a more dedicated approach. Consequently, the EC has introduced the concept of circular public procurement (CPP) as: "the process by which public authorities purchase works, goods or services that seek to contribute to closed energy and material loops within supply chains, whilst minimising and in the best case avoiding the negative impacts and waste creation in the environment. (European Commission, 2017) [10].

The circular public procurement (CPP) is a component of the green public procurement applied in some EU member states. For instance, in 2013 the Dutch government issued a Circular Procurement Green Deal, stating that public and private entities start circular procurement pilot projects to develop capacity, sharing insights and best practices from stakeholders. About 100 pilot projects were initiated in the next 3-4 years, of over EUR 100 million value (One Planet Network, 2019) [25].

Table 1. Policies recommended for circular procurement in the European Union

| **Policies to expand circular procurement by the EU and member states** |
|---|
| Reorientation of procurement rules towards circular procurement (with circular products favoured over linear alternatives) |
| Procurement standards through thresholds for percent of recycled content, reusability, and eco-efficiency |
| Continuous expansion of CP to create markets for circular product producers |

Source: Adapted from (Alhola et al., 2019) [1].

A recent study on the role of public policies in promoting Circular Economy has used among other methods, the interview with stakeholders and CE experts who were convinced and optimistic about circular (public and private) procurement as an efficient and necessary lever in CE transition. However, the main conclusion of the study was that the direction to a holistic and sustainable circular procurement CP regime requires not only reforms of tendering criteria but also a change in the way governments conceptualize CE (Hartley K et al.(2020) [19].

Another study concluded that public procurement can promote CE and related business models through specific criteria and requirements, such as: extending life-span of products, resource efficiency and/or intensity, higher recycling of materials. These conclusions and recommendations are summarized in Table 1. (Alhola et al., 2019) [1].

**The importance of the public procurement in European Union countries**

Public procurement (PP) is represented by a purchase by governments and state-owned companies of goods, services and works and has a direct impact on the economy. European national governments allocate approximately EUR 2 trillion for public procurement annually, accounting for 14 percent of EU GDP (European Commission, 2019) [11], meaning a quite large amount for green and/or circular procurement may be feasible.

According to a recent paper, public procurement could represent an important tool to foster the green transition in the European Union (Sapir A. et al., 2022) [30]. Thus, the level of the estimated public expenditure as %GDP varies from only4% in Portugal to around 18% in Finland, 15% in France, 14% in Belgium and 8% in Romania (Figure 1).

However, in order to make our research deeper and be able to search for a more direct correlation between the public procurement financial policy instrument and the transition to circular economy in the EU member states, it is also useful to know how to estimate the size of the PP (as % of the GDP).

General government procurement is defined as the sum of intermediate consumption (goods and services purchased by governments for their own use), gross fixed capital formation (acquisition of capital excluding sales of fixed assets) and social transfers in kind via market producers (goods and services purchased by government and supplied to households) (OECD, 2011) [24].

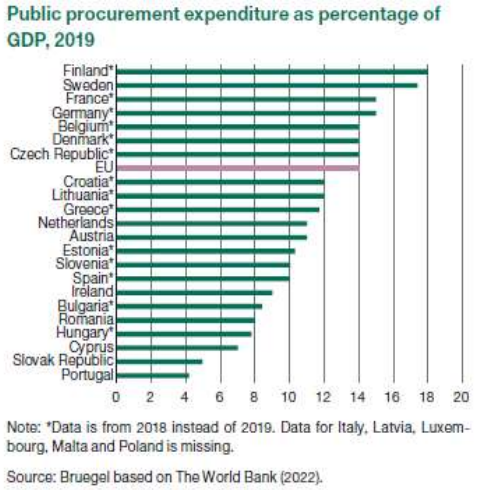


Fig. 1. Public procurement expenditure as % of GDP in selected EU countries in the year 2019
Source: Bruegel. org., Bruegel Annual Meetings, 607 Sept. 2022, https://www.bruegel.org/events/bruegel-annual-meetings-2022, Accessed on December 10, 2022 [3].

From the perspective of the transition to the circular economy, in the EU countries, the most important indicator of public procurement, for which we will carry out more detailed analyses, is the Intermediate Consumption of General Government, as it appears in the Government Finance Statistics database of Eurostat.

**Intermediate Consumption of General Government (% GDP)**

The government intermediate consumption (ICGG) involves the purchase of goods and services by general government. Intermediate consumption is a concept of national accounts that measures the value of goods and services consumed as inputs by a production process. It excludes fixed assets whose consumption is recorded as consumption of fixed capital.

Intermediate consumption is valued (recorded) at purchase prices. This indicator may be relevant to the extent that a circular public procurement policy is applied, given that the statistical-economic literature suggests that the level of this indicator is reduced as the transition to the circular economy takes place (Mihai et al., 2018) [21].

With regard to the evolution of the intermediate consumption of general government (ICGG) indicator, expressed as % of GDP, over the period 2009-2020, Table 2 and Figure 2 show some small differences between the EU aggregates (27 states) and the Euro area (EA, 19 states) respectively, as well as the annual minimum and maximum values of this indicator, in the EU Member States.

Table 2. Intermediate consumption of general government in the EU and Euro Area (ICGG, % GDP, 2009-2020)

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | *Average* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EU | 5.8 | 5.8 | 5.7 | 5.7 | 5.7 | 5.7 | 5.6 | 5.6 | 5.5 | 5.5 | 5.6 | 6.1 | 5.69 |
| EA | 5.5 | 5.5 | 5.4 | 5.5 | 5.5 | 5.4 | 5.4 | 5.4 | 5.3 | 5.3 | 5.3 | 5.9 | 5.45 |
| Dif. | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.24 |
| Min. EU | 4.2 | 4.1 | 4.1 | 4.1 | 3.9 | 3.6 | 3.6 | 3.5 | 3.5 | 3.4 | 3.5 | 4 | 3.79 |
| Max. EU | 10.3 | 10.4 | 10.3 | 10.7 | 11 | 10.9 | 11 | 10.8 | 10.8 | 10.7 | 10.7 | 11.3 | 10.74 |
| Romania | 6 | 5.5 | 5.8 | 6 | 5.7 | 6 | 5.9 | 5.6 | 5.2 | 5.2 | 5.6 | 6 | 5.71 |

Source: [14].

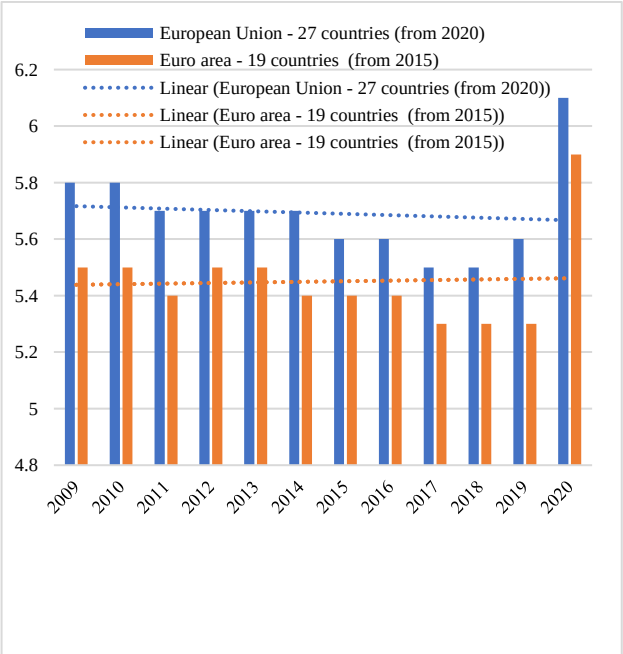


Fig. 2. Intermediate consumption of general government (ICGG) in the EU and EA (% GDP, 2009-2020)
Sources: Own processing of Eurostat data, 2023, Government, expenditure and main aggregates, https://ec.europa.eu/eurostat/databrowser/view/GOV_10A_MAIN/default/table?lang=en, Accessed on October 10, 2022 [14].

In terms of annual evolution, Table 2 also shows the annual evolution of the lowest (EU minimum) and the highest ICGG levels (% GDP) in all the EU countries, respectively. The EU minimum varies between 3.4% (GDP) in Ireland (in 2018) and up to 4.2% in Belgium (in 2009). The maximum value of the indicator was 11.3 %(GDP) in Finland, reached in 2020 but in general, Finland has

the highest level of ICGG, of over 10%GDP, in the entire period 2009-2020 (Figure 3).

In Romania, the trend was slightly decreasing, with a maximum of 6% GDP in 2009, 2012 and 2020 and a minimum of 5.2% of GDP in 2017 and 2018; this trend is welcome from the point of view of implementing the circular economy, especially if green and circular public procurement is carried out.

It may be noted from Figure 3 that in the other countries the average ICGG was between 5-8% GDP, in 2009-2020.

In Figure 3 the 27 EU countries are highlighted in increasing order of their average level of ICGG (% GDP) to see which are the smallest and the largest general government intermediate consumers in the European Union.

It can be noted that, in terms of the level of percentage to GDP ratio, in the period 2009-2020, ICGG had a stable or slightly decreasing trend, both at EU level and in EA, with an average annual level in the EU of 5.69% (GDP) and 5.45% (GDP) in EA, respectively, so in the Euro area the indicator level was at least 0.2 (%GDP) lower, every year.

In 2020 this trend stopped and the indicator increased significantly compared to 2019 (by 9% in the EU and 11% in EA) due to the Covid-19 pandemic and the quarantine period, which brought measures to increase the public procurement of services, medical supplies and masks, medicines, etc.

On the other hand, in order to have an idea of the correlation between ICGG as a proxy for green public procurement and the circular economy (CE) it is important to measure also the degree of circularity in the national economies of EU member states.

In this respect it may be considered the synthetic CE indicator Circular Material Use Rate (CMUR) in the EU. CMUR (unit of measure %) is used to monitor progress towards a circular economy in the secondary raw materials area.

Circular use of materials, also known as circularity rate, is defined as the ratio of circular use of materials to the overall use of materials.

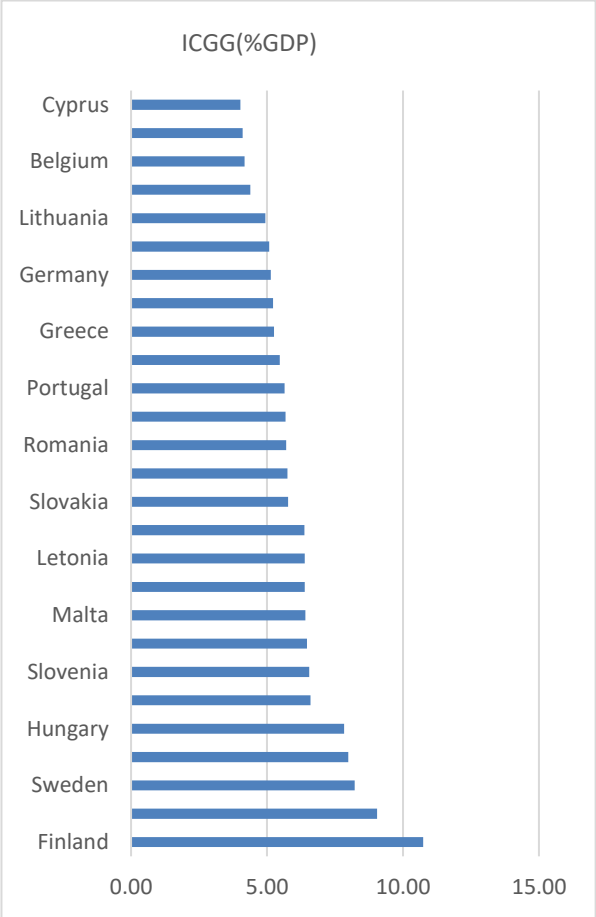


Fig. 3. The average level of the indicator Intermediate consumption of general government, EU-countries, 2009-2020

Sources: Own processing according to Eurostat data, Government, expenditure and main aggregates, https://ec.europa.eu/eurostat/databrowser/view/GOV_10A_MAIN/default/table?lang=en, October 10, 2022 [14].

A higher CMUR value means that more secondary materials replace primary raw materials, thereby reducing the environmental impact of raw material extraction. The data source is the European Statistical System (ESS), and the data provider is the Statistical Office of the European Union (Eurostat).

Figure 4 shows the CMUR indicator, by EU country, for the period 2010 - 2020 (average, in %). It can be seen that the most advanced countries in the EU are: the Netherlands, with a CMUR value of 27.5%; France (18.6%) and Belgium (18.5%). The degree of circularity drops to a minimum value of 1.8% (Ireland). Romania registered also a low average CMUR of only 2.1%, in the period of analysis.

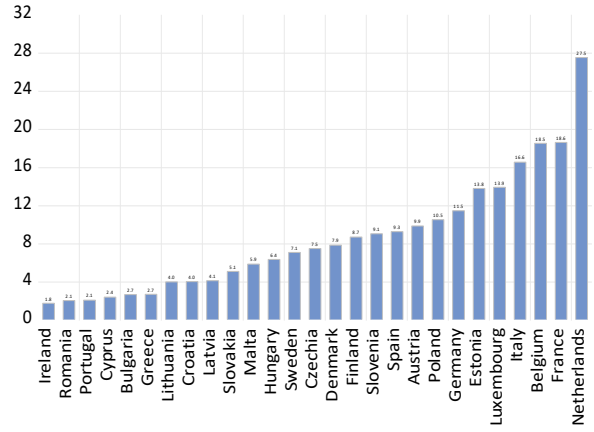


Fig. 4. CMUR average, by country, 2010 – 2020 (%)
Source: own compilation from Eurostat, EEA, CMUR, Circular material use rate in Europe, https://www.eea.europa.eu/ims/circular-material-use-rate-in-europe, Accessed on October 10, 2022 [15].

By comparing Figure 3 and Figure 4 it may be noticed that in general, EU countries with a lower average intermediate consumption of general government (2009-2020) such as: Luxembourg, Belgium, France, Germany are also those with advanced CE, measured by the CMUR. This fact suggests that indeed, a lower intermediate consumption of the general government is an indicator of circular economy progress, that should be further researched through more advanced econometric and modelling techniques.

A lower ICGG may be eventually obtained by Circular Public Procurement since that means reusing and recycling of resources and products already acquired. However, green and circular public procurement may be developed also by greener and circular criteria, rules, and orders within the public sector. Besides special criteria for circular CPP concerning the waste management, governments should also embrace and promote a circular life-cycle costing (Hartley K et al.(2020) [19].

**Performance and prospects of public procurement for promoting CE in the European Union and Romania**

The policy of public procurement in the EU countries is ruled by EU legislation but only for contracts with a value higher than a threshold (different from sector to sector) and in international tenders.

The national public procurement rules are applied in less value tenders. (European Commission, 2022) [9].

There are not yet many precise GPP and even less CPP mandatory targets at the EU level, so the size of the green and even more important, circular public procurement depends on the national strategies and action plans of the EU member states.

These strategies and plans are quite different, since there are countries (Romania, Estonia, Hungary, Luxembourg) without a National Plan of GPP or with no national GPP targets while others have set a minimal share of all PP contracts to include green criteria (European Commission, 2021) [8].

In the most circular economy of the European Union, Netherlands (Figure 4), the share is 100%, a fact that seems to prove the importance of the GPP as circular economy policy.

In the respect of PP as a driver of CE in the EU, a recent survey on the circular economy policy innovation and good practice shows that lately, the Member States have introduced CE elements into five different policies, on average, with a wide horizontal scope of circular economy.

The number of countries reporting having introduced CE elements in public policies is quite high: 17 in Waste management, 13 in the Energy and Climate Plan, 12 in Waste prevention and 9 in their National development programmes (EEA, 2022) [13.]

It is obvious that in many EU countries, the public procurement is already a significant CE policy, as may be observed in Figure 5.

Romania is still among the least pro-active and advanced EU member states in GPP (including CPP) although in 2020, public procurement represented approximately 9% of Romania's gross domestic product.

This demonstrates high potential to determine the evolution of the national economy. However, in order to better respond to the current requirements and strategic needs of GPP and CPP, Romania will soon reform its public procurement system in the next period, this being an obligation assumed by the National Recovery and Resilience Plan (PNRR).

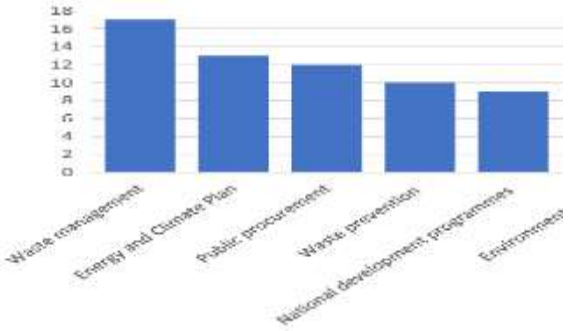


Fig. 5. Number of EU countries with CE elements in their public policies
Source : Extracted and adapted from (EEA, 2022)[13].

The National Strategy in the field of Public Procurement (SNAP) 2023 – 2027 [23] is a project under debate until the end of March 2023. Unfortunately, the justification for the draft of the new strategy shows that, in addition to general problems identified in strategic public procurement, in Romania the exact degree of use of ecological criteria in public procurement processes is not known. According to the National Strategy for Public Procurement draft, the elaboration and adoption of a National Green Procurement Plan is also expected to be carried out in the first quarter of 2024. (ANAP, SNAP 2023-2027) [23]. Nevertheless, special attention will pe paid for green and circular public procurement of agri-food products, belonging to the priority groups of products or services identified as the most suitable for greening by means of public procurement [22].

Actually, the characteristics and opportunities for circular economy business models such as industrial symbiosis in the agri-food sector has been analysed in previous research by (Frone DF, Frone S., 2017) [16].

Last but not least, the recently adopted National Strategy for the Circular Economy in Romania (2022) [28] and the associated Circular Economy Action Plan (CEAP) will further foster the CE benefits of the resource recovering, reusing and recycling and lowering the negative environmental and climate impact, in progress with the sustainable development and European Green Deal strategic goals.

In the newly issued draft of the National Action Plan for Circular Economy in Romania (2023), the Action 4 is dedicated to Integrating circularity criteria into public procurement. In this respect, it is stated that circular public procurement (CPP) could play a key role in increasing the use of circular materials in Romania (CMUR), which is currently (2022) well below the EU average (1.5% in Romania compared to 12.8% average in the EU) and which has deteriorated (from 2.5% in 2018 to 1.9% in 2019) in recent years. Public procurement can also stimulate demand for products that meet reparability and recyclability standards.

The ongoing revisions and developments of the GPP (Green Public Procurement) policy framework offer the possibility to extend the scope to circularity considerations as well. The Government of Romania is currently developing a national GPP plan to set targets and adopt a monitoring framework to ensure implementation.

However, further steps will be needed to increase its adoption. For example, at present, the penalties for non-compliance are too low and public authorities are often not aware of the importance and benefits of green and/or circular procurement. Consequently, the National Plan for Global Procurement, which is currently being developed by the National Agency for Public Procurement (ANAP), should also set binding targets for circular procurement. (NAPCE-Romania, 2023) [29].

## CONCLUSIONS

Circular economy (CE) is the new economic paradigm of reuse, recovery and recycling of resources, reducing the negative environmental impact of production and consumption. The CE is now not only an academic ideal concept but has become an actual strategic objective of the sustainable development and European Green Deal, so all the EU member states must make efforts for a rapid and efficient transition towards the new, greener circular economy.

Some EU countries have been very proactive in promoting the CE by national strategies or at least by dedicated policies such as the green and circular procurement that seem to have been quite efficient as shown by our

analysis performed with the use of the ICGG indicator (%GDP). Unfortunately, Romania is among the least advanced countries in the CE transition, as proved by the penultimate place in Figure 4 (average rate of circular material use, in 2009-2020).

This is the reason why lately Romania has started many projects and adopted the National Strategy for a Circular Economy (2022). Besides, the expected national CEAP (2023) underlines the significance of GPP and CPP as effective policy instruments to implement circular economy in Romania.

Together with the new correlated National Green Procurement Plan the new, circular policies are expected to promote more effectively and rapidly the circular economy business and consumption models at all the levels and in the most suitable sectors, among which the agri-food is a priority one.

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# A FAIR TAX BASE FOR THE MUNICIPAL WASTE CHARGE – KEY TO AN EFFECTIVE WASTE MANAGEMENT POLICY IN THE REPUBLIC OF BULGARIA

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***Abstract***

*Municipal waste management is one of the most complex flows to manage. It is usually delegated to local authorities and funded by the revenue from the municipal waste charge. The critical introduction of the polluter pays principle raises the question of how to reasonably set the municipal waste charge. It should be structured so that it generates sufficient revenue to cover the costs of waste management. At the same time, it should influence human behaviour to reduce waste even at the source. Achieving both at the same time requires a strong link to the tax base of the charge. The fairest one is linked to the amount of household waste. Such a link is necessary to incentivise taxpayers to effectively reduce and manage the waste generated. Bulgaria is among the countries that have postponed such a reform for many years, but it is now becoming inevitable. The main objective of this study is to assess and analyse the current financial instruments and tax legislation related to municipal waste management in the Republic of Bulgaria. The critical point is to evaluate the link between the tax base and the taxpayers' behaviour by setting the municipal waste charge in the Republic of Bulgaria. The methods of retrospective analysis and synthesis, inductive and deductive methods and comparative analysis are used to achieve the aims and objectives of the study. In Bulgaria, an unfair tax base has always been applied in determining the municipal waste charge. It depends not on the amount of waste but on the property's tax assessment. The fiscal policy in Bulgaria related to the municipal waste management needs to be updated to achieve the targets set in the Bulgarian National Waste Management Plan 2021-2028. The change should affect both the methodology of calculating the waste charge to apply the "polluter pays" principle and the system of tax preferences and reliefs to encourage the rational treatment of household waste, such as recycling.*

***Key words*****:** *municipal waste charge, tax base, waste management, Bulgaria*

## INTRODUCTION

Municipal waste accounts for only 10% of the total waste generated in the EU. As European Parliament Directive 2018/851 points out, "*This waste stream is one of the most complex to manage, and the way it is managed is generally a good indicator of the quality of the entire waste management system in a country"* [7]. The complexity of its management stems from the fact that it is generated near citizens and is of a mixed nature. A definition of municipal waste is given in Article 3 of Directive 2008/98/EC. Waste from households and other sources is treated as municipal waste, including " *paper and cardboard, glass, metals, plastic, biological waste, wood, textiles, packaging, waste from electrical and electronic equipment, waste from batteries and accumulators, as well as bulky waste, including mattresses and furniture* " [8].

The philosophy of the circular economy shifts the treatment approach of municipal waste from its environmentally sound management to a policy of reducing its generation and reintegrating it into the economic cycle. The ever-increasing demands and costs of municipal waste management require the combined efforts of the whole of society to achieve a reduction in the harmful impact of waste on the environment, protection of human health, and the maximum efficient use of the planet's scarce resources. Introducing the "polluter pays" principle raises the question of determining the fairness of the waste charge payable by each member of society generating waste.

Urbanisation, population growth and industrialisation are the key factors

influencing the breakneck increase in waste generated. This forces the governments of many developed countries to take care specifically of municipal household waste [2].
The municipal waste levy is the primary revenue source financing municipal waste management policy in Bulgaria. It's proper structuring greatly impacts the value of the revenue raised. This requires a precise definition of the elements of the levy. The most important of these is the tax base. A correctly defined tax base is not only a prerequisite for raising sufficient tax revenue. It is an incentive which, in this case, influences and can change human behaviour concerning the amount of waste generated and its subsequent proper treatment. It thus makes it possible to introduce the "polluter pays" principle.
These arguments call for creating a similar strong link between the tax base and the amount of municipal waste. A link that the Bulgarian tax legislation has never developed. For decades, the municipal waste tax in Bulgaria has been determined based on the tax valuation of the taxed property. The chosen unfair tax base not only leads to insufficient revenues being raised. It creates a sense of injustice and does not change human behaviour. Only a link between payment and the amount of waste can change the Bulgarian's attitude to waste and his concern about how he could reduce it.
The main objective of this study is to assess and analyse the current financial instruments and tax legislation related to municipal waste management in the Republic of Bulgaria. The critical point is to evaluate the link between the tax base and the taxpayers' behaviour by setting the municipal waste charge in the Republic of Bulgaria.

## MATERIALS AND METHODS

In the course of the study, data from Eurostat, Organization for Economic Cooperation and Development (OECD), OECD Policy Instrument for the Environment Database (PINE Database) [17] and Bulgarian National Statistical Institute (NSI) are used [15]. The study period covers the years 1995 to 2020.
A thorough retrospective analysis of Bulgarian legislation and practice in municipal waste tax and the primary law regulating it has been carried out. This is the Local Taxes and Fees Act (LTFA) [13]. The legislation attempts and the impossibility in practice to impose a fair tax base in Bulgaria in the more than 24 years since 1998 are analysed in detail. A thorough comparative analysis of the course of other European countries supports these arguments.
The authors set themselves the following more important tasks with this research:
-To evaluate the current system for setting the municipal waste charge and define the associated with it problems
-To analyse the importance of the problem based on the quantities of municipal waste generated in Bulgaria and the way it is treated
-To propose recommendations for improving the fiscal policy in its part of the municipal waste tax in the selection of an adequate tax base to achieve the targets Bulgaria has set in the National Waste Management Plan 2021-2028 (NWMP) [14].
The methods of analysis and synthesis, inductive and deductive methods and comparative analysis are used to achieve the aims and objectives of the study.

## RESULTS AND DISCUSSIONS

Compared to the EU-27, Bulgaria generated less municipal waste per capita in 2020 - 493kg/capita for the EU-27 and 442kg/capita for Bulgaria.
Figure 1 shows that this has not always been the case – municipal waste generated in Bulgaria until 2010 exceeded the EU-27 average. Since 2011, this trend has reversed positively for the country.
Figure 2 shows the municipal waste treatment in Bulgaria in kilograms per capita. The largest relative share, although gradually decreasing, is the landfilling of municipal waste (62% in 2020).
The NWMP 2021-2028 plans to reduce the amount of municipal waste landfilled by at least 10% of the total amount of municipal waste generated by 2040 [14].

Although it is a fact that the amount of recycled municipal waste is steadily increasing (27% in 2020), Bulgaria has a low level of recycled municipal waste. In the NWMP 2021-2028, Bulgaria has set a target to recycle at least 65% of the total municipal waste by 1 January 2035.

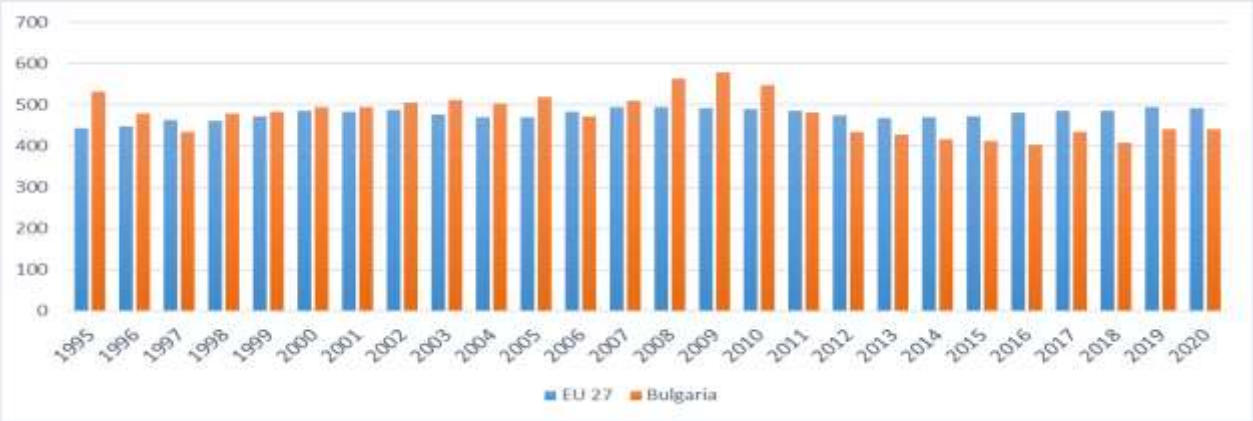


Fig. 1. Municipal waste generated in Bulgaria and the EU-27 1995-2020 (kg/capita)
Source: Eurostat [9].

Composting as a treatment method for municipal waste accounts for a negligible share (8% in 2020). This is also true for using municipal waste for electricity generation in Bulgaria (3% in 2020).

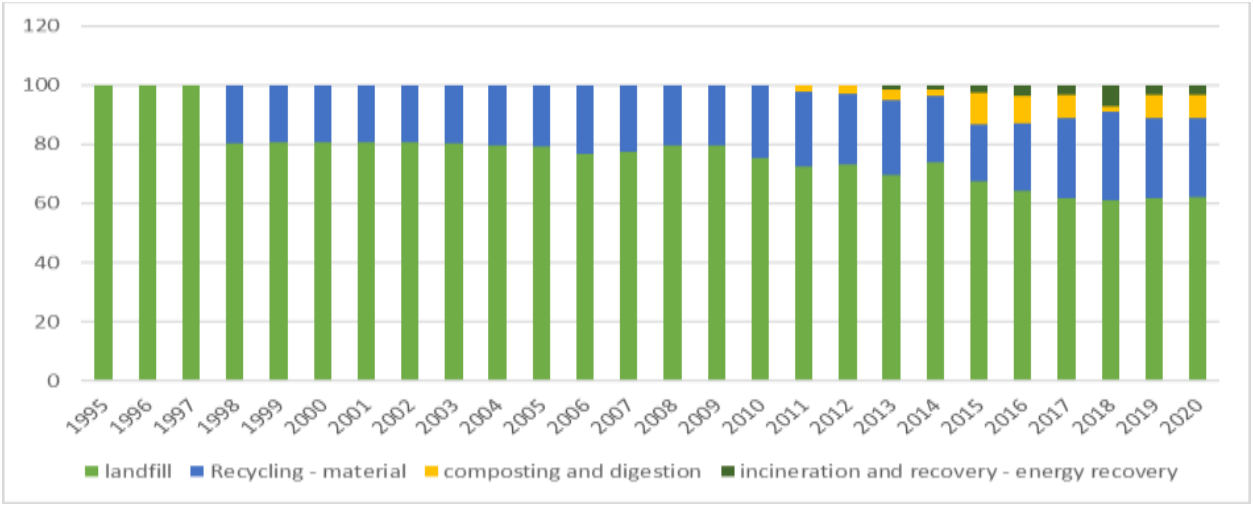


Fig. 2. Municipal waste treatment in Bulgaria in kilograms per capita 1995-2020 (%)
Source: Eurostat [9].

Although Bulgaria is in a more favourable situation than the EU average in terms of the amount of municipal waste generated in total and per capita, there is still much work to be done to prevent the generation of municipal waste, reduce the amount of landfilled waste, and increase the amount of recycled and composted municipal waste. The role of financial instruments is crucial to achieving these objectives and addressing the problems of effective waste management.

**The problems with the Bulgarian legislation**

In Bulgaria, the municipal waste charge is the primary revenue source to cover waste management costs. In Figure 3, we can see the revenues from the municipal waste charge and the expenses related to municipal waste in 2014-2020. It can be seen that by 2017 the revenues exceeded the expenditures. Still, in the following years, there is an opposite trend - the revenues are insufficient to cover the

costs related to municipal waste management. Studies have shown that waste management is almost always a local responsibility [10]. It is the largest expenditure item in local budgets, especially in developing countries. Sometimes the insufficient revenue raised by the local government through the levy is supplemented by funds from the state budget [6].

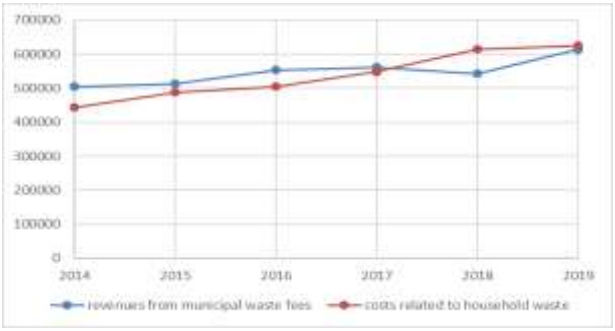


Fig. 3. Garbage revenues and municipal waste management costs in Bulgaria
Source: Authors' interpretation of data from the National Statistical Institute [15].

The municipal waste charge is a particular focus of attention due to the urgent need to reform it. For decades, its infinitely incorrect basis and the lack of transparency have created a sense of unfairness. The legal framework regulating municipal waste on the country's territory is the Law on Local Taxes and Fees Act. Based on the act, each city council introduces an Ordinance on the Determination and Administration of Local Taxes and Fees. According to Art. 67 of the Act, the quantity of municipal waste is the guiding basis for determining the amount of municipal waste charge [13].
However, the law allows the municipal council to adopt a different basis or base, provided objective circumstances prevent its application. No such justification has been provided for the local authority's inability to consider the amount of municipal waste. The most common basis chosen remains in force in our legislation, namely the property tax assessment. This automatically equates the charge to property tax, effectively doubling it. The "polluter pays" principle is not respected but disturbs the levy. It is not linked to the costs of providing the necessary material, technical and administrative costs of providing the service - a condition laid down in Article 7 of the law. This results in insufficient revenues, necessitating individual municipalities to supplement the expenses with other revenues.
However, the most crucial problem remains the inability of the levy to fulfil its natural economic functions, namely to influence:
1. the quantity of municipal waste
2. the ways of its subsequent treatment.
The need for reform in Bulgarian legislation has long been recognized but not realized. With the very adoption of the text of the new Municipal Tax Act in force since the beginning of 1998, the previously used basis was replaced with a new one - the quantity of municipal waste. Thus, the State effectively transferred to the municipalities the responsibility for devising the mechanism for accounting for the quantity of waste. It is a question that requires not regional but state intervention and a concept whose solution lies outside the administrative capacity of local authorities in the Republic of Bulgaria. Where the quantity cannot be ascertained, the law retains the application of the tax assessment. At the end of 2002, with a delayed start for enactment in early 2004, the legislature formally repealed such an inequitable basis. When the amount of waste cannot be ascertained, the fee is assessed in leva per user or proportionally on a base set by the municipal council. A new paragraph 16 is added to the additional provisions of the law. It attempts to define the meaning of the concept of the base, namely "an objective indicator in value terms, based on the percentage or *per rata of the proportional charge is determined or natural indicator on the basis of which the charge is determined per unit/e.g. BGN/1 person, BGN/ cubic meter of used water, etc."*. Thus, for the first time, the possibility of linking the tax base to criteria such as the number of inhabitants in a household or its utility costs is implicitly mentioned. In both cases, the common point is that there are all indicators that at least have a bearing on the amount of garbage potentially generated, as opposed to the value of the property. However, there has been no real change, and the municipalities continue

calculating the fee based on the tax value of the real property.

Nine years later, in 2013, with a delayed start for taking into effect at the beginning of 2015, the law added a requirement that the basis determined by the municipalities could not be the tax valuation of real property, its book value or its market price. It also sets a deadline of June 30, 2014, for the Council of Ministers, together with the National Association of Municipalities in the Republic of Bulgaria, to develop a methodology for the preparation of the plan account with the necessary costs for the activities and the types of bases that serve to determine the amount of the fee. These legislative changes do not lead to a new way of determining the levy and its tax base. For the next three consecutive years, the only changes in the law are in each of them a postponement of the deadlines by one year.

The year with a more specific change was the end of 2017 when amendments with a particular environmental focus were introduced. This is the introduction of:

-the ecological component in the determination of the vehicle tax

- the principle of bearing the costs by the user.

The Waste Management Act defines the nature of the “waste producer” concept [25]. Waste management services are divided into components; the law mentions the tax base for each. The common one that applies to all three types of services is the number of users in the property. In addition to that, for the services of collection, transportation and disposal, “*the basis may be an individually determined quantity of household waste for the property, including using bags of a certain capacity and carrying capacity, or a quantity of household waste for the property determined according to the number and capacity of containers required for the collection of household waste and the frequency of their transportation*". In the case of services for maintaining the cleanliness of the areas for public use, the alternative basis is the expanded built-up or unbuilt-up area. Once again, a further year's delay is granted for developing the new methodology. The definition of the "base for determining municipal waste charge" is also changed, namely "*the indicator, based on the costs on account of the municipal waste charge from the approved plan-account are allocated to the obliged persons. To set the municipal waste charge, the unit of measurement for the basis quantity of municipal waste shall be the kilogram or litre”.*

In practice, the municipalities in Bulgaria are not consistent and logical in determining the tax base of the municipal waste tax. A study of the tax bases used to determine the municipal waste charge in 12 municipalities in Bulgaria found that in none of the municipalities studied, the criterion "number of users of the service in the property" is not taken into account when determining the tax base. Only half of the studied municipalities offer the possibility for the enterprises to choose the tax base between the tax value and the book value of the properties; the tax base applied does not stimulate waste reduction. [1].

An interesting fact with the introduction of a new Art. 71 b is the attempt to ensure transparency in determining the tax base. According to the new law, data on the adopted plan, the tax bases chosen, the reported expenditure from the previous year, and the quantities of waste generated will be published on each municipality's website by February 15. The deadline for enacting the requirement that the basis cannot be the tax valuation is extended by one more year until the end of 2019. Therefore, it is still the applicable base for calculating tax liability. At the end of 2018, this deadline is extended by two years until 31.12.2021. In 2021, the deadline was extended again to 31.12 of the year following the publication of the results of the 2021 population and housing census [20, 21]. Then the requirement for developing a specific methodology by the Council of Ministers and the National Association of Municipalities in the Republic of Bulgaria is also cancelled. Thus, a supposedly categorical will to change the tax base in Bulgaria has been postponed for ten years.

Despite the apparent will of the law, the "polluter pays" principle remains

unenforceable in Bulgaria. This contradicts the Waste Management Act, which aims to create natural market mechanisms to reduce waste and optimize its treatment. This objective cannot be achieved without a fundamental change in determining the tax base. In October 2022, NSI in Bulgaria published its final data from the 2021 census [21]. In this way, 31.12.2023 is the next deadline for reforming the municipal waste charge.

Bulgaria is one of the few countries that use a base in no way related to the amount of waste. Even when the charge is paid as a surcharge on utility bills, it is still testimony to the amount of waste that may have been generated. Most countries' tax base is measured in kg or litres. Rarely the base is in an absolute amount per person. Bulgaria is the latest possible laggard with its municipal waste reform, and its base is as unfair and imperfect as possible. All of this raises the question of a new methodology that has to consider waste quantity. Developing such a particular methodology is undoubtedly outside the power of individual municipalities. Active state intervention is needed, even though the charge is local. Given the national psychology of Bulgarians and the lack of culture in waste management, this change would be challenging. It is no coincidence that the law itself, although requiring it, has delayed it for over 20 years.

**The practice in other EU countries when charging municipal waste**

The practice in different countries regarding charging household waste is interesting [5]. In Belgium, some Flemish municipalities use bags for residual waste sold by the municipality, while others use an electronic recording of the weight of the waste submitted for collection. Household waste management costs are financed as follows: 1/3 through a flat fee from households, 1/3 through PAYT fees and 1/3 from the municipal budget.

In the Brussels region, fees are collected from households that pay a regional tax per household to the municipal budget. There is a door-to-door separate waste collection system. Citizens buy special waste bags in shops at cost price. The containers are free of charge.

In Wallonia, the municipalities have a fixed fee to cover minimum waste management services and charges for additional services by purchasing bags and collecting green and bulky waste.

In France, municipalities can choose between three options when setting the municipal waste collection charge. The first two are fiscal - the value of the property and the volume of waste collected. The third option is for the municipal budget to cover waste services. The latter is financed by local direct taxes - residential tax, built-up property tax, unbuilt property tax, and territorial-economic contribution.

In Austria, in most communities, the waste charges have two components – a basic charge and an additional service charge based on the amount of municipal waste. In parts of Austria, fees are calculated based on the amount of household waste.

In Spain, municipalities are allowed to set three general and an unlimited number of special rates based on economic and environmental factors. Differentiated rates for households and businesses apply. In some municipalities, the rates are fixed; in others, rates are based on criteria not directly related to the waste generated. The charges are not collected by the municipalities but by the electricity suppliers, together with the recurrent electricity bills.

In Finland, the fee is set on a combined basis, considering the size of the bin and the frequency of collection, and the fraction of waste. Waste collection in Ireland is the entire private sector. Companies collect fees respecting the "polluter pays principle" and encourage customers to separate waste collection. The charge includes a service charge which is a fixed amount and a variable part based on weight, bin lift, frequency of service, etc.

The practice in Korea is also interesting because, to some extent, it is similar to the Bulgarian one [12]. Until 1995, the municipal waste fee was also set in an absolute amount without regard to the amount of waste generated. To reduce the amount of waste at source and encourage recycling, the Korean government introduced the Volume-Based

Waste Fee in 1995. For this purpose, garbage is disposed of in special bags. This creates incentives to reduce the amount of waste, as payments are now linked to the quantity. Separately, a free collection of recyclables is provided. In this way, taxpayers are motivated to set aside as much of their garbage for recycling as possible instead of throwing it away in bags for which they have to pay [19]. It is no coincidence that South Korea is among the top OECD countries in the recycling rate.

Table 1. Waste tax bases in EU countries

| Country | Name of Instrument | Tax base or rate - Euro |
|---|---|---|
| Austria | Waste deposit levy | per tonne |
| Belgium | Tax on waste collection | 50.00 - 60.00 € per m³ of waste |
| Czech Republic | Charge on municipal waste collection | According to expected costs for a municipality (Waste Law) or up to 27.65€ per person per year (Local Charges Law). Municipalities can choose one type of charge or can also use a contractual relationship. |
| Denmark | Charge on municipal waste collection/treatment | 63.79 € per tonne |
| Estonia | Waste disposal charge | per tonne |
| Finland | Charge on municipal waste collection/treatment | Ton or m³ of waste collected |
| France | Charge on municipal waste collection/treatment | The volume of collected waste |
| Greece | Charge on municipal waste collection/treatment | payment with utilities |
| Hungary | Charge on waste disposal | per tonne |
| Ireland | Landfill levy | per tonne |
| Italy | Charge on municipal waste collection/treatment | The volume of waste, level of service, and operating costs of treatment |
| Latvia | Municipal waste user charge | Collection of waste, 240-litre containers 1.18 € per container |
| | | Waste generated by enterprises, volumetric charge 5.79 - 7.51 € per m³ |
| | | Waste generated by households is a fixed charge of 0.3382 € per person per month. |
| | | Waste generated by households, volumetric charge 5.27 - 5.37 € per m³ |
| Lithuania | Municipal waste user charge | 3.17 - 6.52 € per m³ |
| Malta | Landfill charges | per tonne |
| Netherlands | Waste tax | 17.00 € per 1000 kg |
| Norway | Charge on municipal waste collection/treatment | The volume of collected waste (per container, size of the bag, number of collections per week) |
| Poland | Charge on municipal waste landfilling | per tonne |
| Romania | Waste user charge | Households 1.35 - 18.9€ per person per year |
| | | Industries 5.4 - 21.6€ per m³ |
| Slovenia | Waste user charge | Quantity of waste |
| Spain | Tax on waste disposal in landfills | per tonne |
| Sweden | Tax on the deposition of waste in landfills | per tonne |
| Slovak Republic | The charge for deposition of waste to landfill and sludge-deposition sites | per tonne |
| | Waste disposal fee | |

Source: OECD, PINE Database [17].

Thus, the already changed accrual tax base is yielding outstanding results. In the eight years since the new system's introduction, garbage has decreased by 16.6%, and recycling has increased by 27.3%.

According to studies, this decrease is particularly significant in the first years of the

system's introduction, considering the relationship between payments and the amount of garbage generated [22].

The waste tax bases in some European countries can be traced in Table 1.

**Possible changes in Bulgaria**

*First.* The main problem in applying the "polluter pays principle" is the lack of technical provision for towing the waste to the source. Here we can use the experience of other European countries where the two approaches are most common. In the first approach, the fee is set based on the capacity of the bins and the frequency of their removal. A second approach is to provide for the purchase of special bags or stickers, the purchase price of which includes the fee itself.

*Second.* A good option might be a step change. The practice of other countries that have introduced a volume-based system as the basis of a municipal waste fee shows exactly a phased introduction through "creating the right social atmosphere, conditions for implementation, pilot projects, etc." [11].

In the first stage, waste reporting could start from smaller settlements. The predominantly single-family houses could easily be provided with separate containers of a specific capacity. Apart from that, these areas usually generate less garbage. In many cases, it is organic, and people use it either as animal feed or in the composts they often own. The experience and data accumulated over several years could serve as a basis for developing the methodology for larger cities. Where quantity accounting is considerably more difficult, a criterion of the number of household members could be introduced as a first phase. It is unnecessary to break down the number of family members too much to avoid creating too many administrative difficulties and speculations. Set the fee in an absolute amount on a cost-covering basis only for two categories - a household with one member and with more than one. This would resolve another inequity in our legislation. According to Art. 64 and Art. 11 of the law, the charge is payable by the owner of the property. The exceptions apply only to users under an established right of use and concessionaires. In all other cases of rental property, the fee is charged to the owner and not the actual user of the services.

*Third.* The accurate reporting of the municipal waste charge is directly related to the software support of municipal waste management. The databases created will enable communication between the parties involved in the municipal waste management process and the possibility of analysis and control [3, 4].

*Fourth.* Since the guiding principle in European and, therefore, national legislation is the"prevention" of waste, the practical implementation of this principle requires changes in the regulatory framework. The introduction of various taxes and charges on businesses if they produce less waste, the incentivisation of the donation of products that would become waste, the introduction of tax preferences for citizens when reducing the amount of waste generated, etc.

*Fifth.* The deposit system applied in many European countries shows promising results [24, 23, 16, 18]. It consists of the payment of a deposit in the price of water and other beverages sold in plastic bottles, aluminium cans, boxes, and glass bottles, which is refunded to the consumer after their return to the points specially set up for this purpose. The practice in other countries has shown that recycling packaging from these products increases many times while reducing the costs of collecting and transporting municipal waste.

Sixth. Implementing policies related to waste reduction should be supported by information and education campaigns at the national and local levels. Education as early as kindergarten and then at school is essential for self-awareness in the younger generation to care for and protect the environment. This is where non-governmental organisations have a role to play, and they should be supported by the state and municipalities in their activities.

## CONCLUSIONS

The fiscal policy in Bulgaria related to the municipal waste management needs to be updated to achieve the targets set in the Bulgarian NWMP 2021-2028. The change should affect both the methodology of

calculating the waste charge to apply the "polluter pays" principle and the tax preferences and reliefs for implementing activities related to municipal waste treatment. The analysed practices in several European countries show good results and can be borrowed and applied in Bulgaria. The role of information and education campaigns and changing people's self-awareness that these measures are for the health and well-being of the whole society. Sometimes we must compromise our comfort and convenience to achieve a nobler purpose.

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# EVALUATION OF THE QUALITY OF CHEESES PRODUCTION INTENDED FOR COMMERCIALIZATION THROUGH THE USE AND COMPETITIVENESS OF SOME STARTER CULTURES OF MICROORGANISMS

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***Abstract***

*The aim of the scientific investigation study was to evaluate the quality of cheeses production by involving some starter cultures of microorganisms and to evaluate the study of the cells of the fermentation microbial populations according to their qualitative aspects and their competitiveness. Mesophilic, thermophilic and mixed lactic starter cultures and their contribution to fermentation processes in manufactured cheeses were studied. Also, in the scientific article was analysed the value chain of cheeses and the necessary conditions for running a successful cheeses business in the rural environment. The article describes also the problems agricultural farmers are facing towards commercialization the cheeses. The starter cultures were used as materials for elaboration of the article, in the same time were used tests for the research of the process of fermentation. The main results of the research demonstrated that the use of the economic performance of the can be achieved using starter microbial cultures in the process of production of cheeses. The conclusions of the research are that at the process of cheeses fermentation a big contribution play mesophilic, thermophilic and mixed lactic starter cultures.*

***Key words*****:** *consumption, organic products, Romania*

## INTRODUCTION

The competitiveness of dairy products depends of raw milk quality, quality management in milk processing and commercialization [10, 11, 12].
The progress recorded in the use of microorganisms at the industrial level has always aimed at obtaining high-performing starter cultures, with improved properties suitable for the purpose for which they were created. The general concepts of starter cultures were initially used only for lactic acid bacteria. Over time, its use has expanded to all cultures selected through exogenous involvement at different stages of the technological process, these being called complementary or secondary starter cultures. The improvement and coordination of the activity of selected microorganisms, used in the form of starter cultures and able to coexist with the indigenous milk microbiota, much more adapted to the technological conditions, has currently allowed both the modernization and the continuous diversification of cheese assortments [1, 3, 5].
The evaluation and establishment of the composition of the starter culture takes into account both the specific characteristics of the finished product and the requirements of the consumers, therefore the starter cultures of lactic bacteria are designed in such a way as to meet all the objectives aimed at the processing of milk and the quality of cheeses [2, 4, 6].
Some bibliographic studies reveal the importance of the thermophilic cheese starter, which is considered to perform excellently at high temperatures. That is why they are used in the production of cheeses with Italian extract. This is "Mozzarella", which is distinguished by an unforgettable taste and the love of consumers [8, 13, 14].

At the present moment, the importance of the involvement of obtaining and using high-performance starter cultures has led to the orientation of their production by specialized multinational companies, which permanently orientate their research and production in accordance with the requirements of food producers. Therefore, it is considered that it would be ideal for the cheese producer to permanently use the same starter cultures in order to eliminate technological or qualitative variations. In practice, however, in view of the sensitivity of crops to beech attack, crops are rotated. For these reasons, starter crop producers pay special attention to the quality of starter crops in order to obtain high-performing strains that can be used permanently without rotation [7, 9].

For these reasons, the main objectives of these researches are the evaluation of the quality of cheese making by involving starter cultures of microorganisms and the evaluation of the study of the cells of the fermentation microbial populations according to their qualitative aspects and competitiveness.

## MATERIALS AND METHODS

The experimental part of the work was carried out in the microbiology laboratory of the Faculty of Veterinary Medicine. As material, starter cultures of various categories used in the manufacture of cheeses were researched. Tests were used to investigate the study of cells of fermentation microbial populations by quantitative and qualitative aspects.

## RESULTS AND DISCUSSIONS

The average annual consumption of cheeses in Moldova is 4,000-5,000 tons.

The most wanted cheeses by the population from Moldova are „Rossiyskiy" (Russian), „Goladnsky" (Dutch) and on the third place comes „Poshekhonskiy". Also moldovans prefere „Edam" and „Gouda", but the share of these cheeses are insignificant.

In Moldova, cheeses are imported from Ukraine and EU (75% of all cheeses). In the same time, in the last years, was registered an increase of cheeses export in Moldova from Belarus.

The biggest producers from Moldova of cheeses are: Lactis JSC and Lactalis Alba.

Lactis JSC is a big company where 280 people work which produces 17 types of cheeses. The company opened more than 90 milk collection points in vilages from more than 7 districts from Moldova.

Lactalis Alba LLC imports mostly cheeses from France, but alsoe produces cheeses in the factory located in Soroca. French entrepreuners registered investments in this company more tha 17 mln USD. It is a big company with more than 220 employees.

In Moldova also produces cheeses the following factories: MilkMark, JSC Cahul („Estonsky" - Estonian), JLC Group.

According to Statista.com, it is expected that in 2023 the revenues in the cheeses segment to constitute 282.10 mln USD. During 2023-2027, it is expected that the market to grow annualy by 3.79%. By 2027, it is expected that the volume of cheeses segment to constitute 19.09 m kg.

The study of the economic characteristics of the starter cultures regarding their involvement in the manufacture of cheeses shows us the data of Table 1.

Evaluating some properties of the starter cultures we were guided by the importance of some categories of commercial starter cultures and the ways of their use in the practice of manufacturing cheeses with an efficiency higher economic.

The importance of this study is of interest for the acquisition and use of starter crops as well as the orientation of their production by various specialized producers, who permanently orientate their research and production in accordance with the requirements of food producers.

Therefore the successive multiplication of microbial cells until they achieve the levels that ensure the necessary concentration to start lactic fermentation are provided by the methods of obtaining starter production cultures. Over time the methods of obtaining the inoculum have evolved simultaneously with the modernization of the technologies of production.

Analyzing figure 1 gave us the possibility to deduce some interpretations of differentiation in the result of the investigation of the homofermentative and heterofermentative mesophilic starter cultures.

The lactic microbial species Lactococcus lactis and Lactobacillus cremoris recorded various quantitative behaviors regarding the number of lactic microbial cells with fermentative activity. The values in Figure 1 reveal a higher number of lactic cells of the species Lactococcus lactis constituting 22/28 cells compared to the species Lactococcus cremoris, which registered 18/14 lactic cells.

Table 1. The analysis of economic characteristics related to the starter cultures used in production of cheeses

| No. | Characteristics | Starter cultures | | |
|---|---|---|---|---|
| | | Mesophilic | Termophiles | Mixed |
| 1 | Production cost | medium | medium | medium |
| 2 | Technological restrictions | small | big | big |
| 3 | Conservation costs | small | medium | medium |
| 4 | Time required to obtain starter cultures | 72 hour | 48 hours | 48 hours |
| 5 | Crop diversity and market availability | good | good | good |

Source: elaborated by the authors.

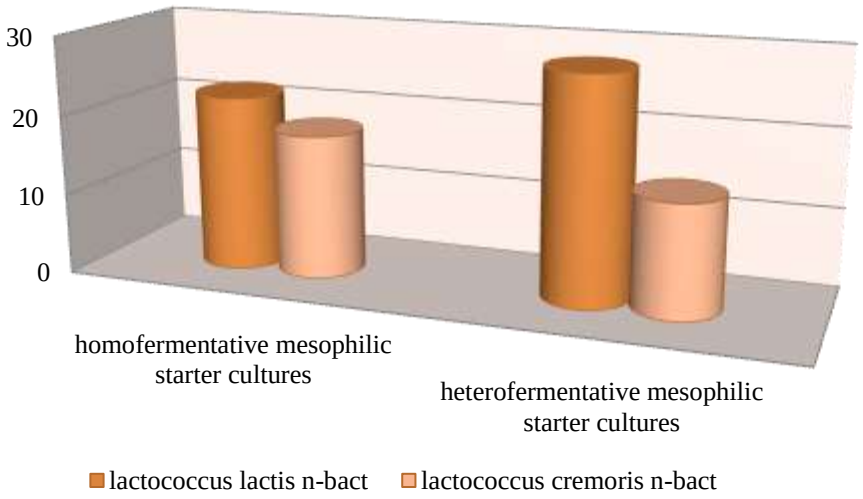


Fig. 1. Evaluation of the fermentation evolution study of mesophilic starter cultures used in cheese making (Number)
Source: elaborated by the authors.

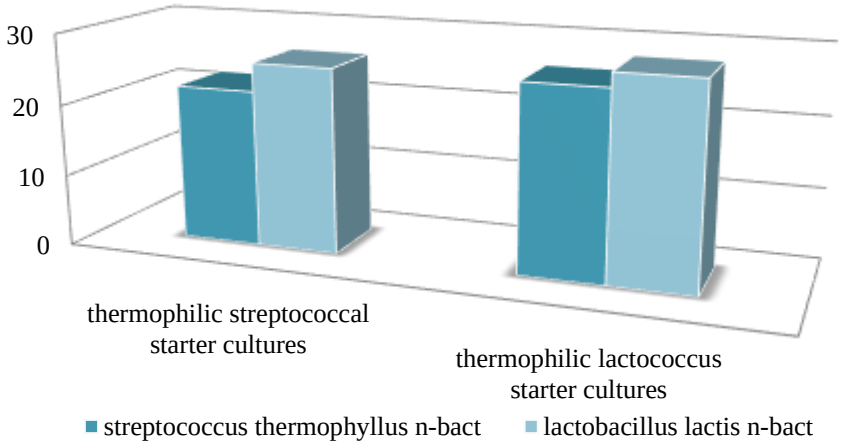


Fig. 2. The analysis of the evolution of fermentation of thermophilic starter cultures and their impact on production of cheeses (Number)
Source: elaborated by the authors.

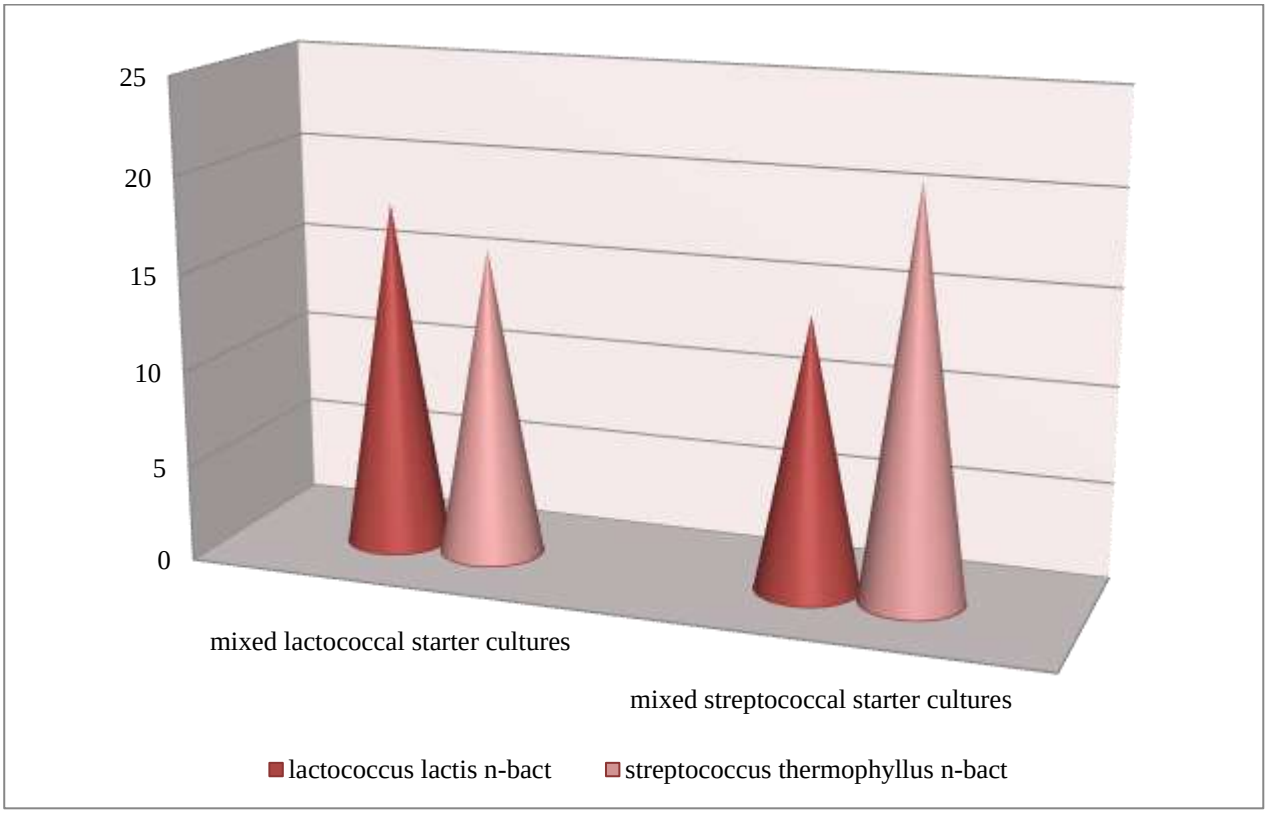


Fig. 3. The study of mixed starter cultures and their impact on the fermentation evolution in the process of producing cheeses (Number)
Source: elaborated by the authors.

These differentiations of fermentation processes by means of starter cultures is not only a means to provide, maintain or improve the keeping qualities of the product but also presents the fermentation process in cheeses with a strong impact on its quality and acceptability.

Scientific studies confirm that during the fermentation process the primary nutrients from milk, such as high-quality protein compounds, calcium, phosphorus and vitamins of the B complex, remain available and give high nutritional value to the fermented dairy product. But, more importantly, these fermented dairy products can exceed the limit of nutritional properties by becoming functional if the fermentation process is optimally managed. The aroma, viscosity, microbial and chemical characteristics can be affected by the size of the inoculum added to the milk, by the presence of agitation during fermentation or other such aspects.

Important indices of the thermophilic starter cultures are shown in Figure 2, according to which were determined some aspects of the starter cultures with the implication of lactic species Streptococcus thermophyllus and Lactobacillus lactis, where the recorded number of lactic bacteria of these thermophilic cultures constituted 22/26 microbial cells at bacterioscopy in the Streptococcus thermophyllus species and 26/28 lactic microbial cells in the Lactobacillus lactis species.

According to the obtained results, was registered the highest number of Lactobacillus lactis species, these results being caused by a more intense development and acceleration of the fermentation processes in cheese making with the active participation of the thermophilic starter cultures of microorganisms.

According to our analysis, we can conclude that thermophilic starter cultures in this investigation conditions presented a fermentative metabolism which is well-determined and with high importance to the process.

Analyzing the Figure 3, we can reveal the number of microorganisms at bacterioscopy of the mixed species Lactococcus lactis, which compared to the species Streptococcus lactis, constituted 18/14 microbial cells and Streptococcus thermophyllus, which revealed values of 16/21 lactic fermentation germs involved in the microbiological biotechnological processes of cheese manufacturing.

All microbiological indicators showed a high microbiological innocuousness, a fact due to strict compliance with hygiene requirements.

From the results presented above, we deduce that the lactose present in the raw material milk was consumed during the fermentation process by the inoculated lactic bacteria.

Based on the studies carried out, the starter cultures have a high importance in the process of production cheeses.

These characteristic researches are of public interest and allow us to make remarks, that mesophilic, thermophilic and mixed starter lactic cultures where the bacterial species Lactococcus lactis predominate are characterized by the presence in the area of the specific imprint of amino acids, nucleic acids, polysaccharides, proteins and esters, which contribute to the fermentation processes in manufactured cheeses. The presence of these compounds is in accordance with the data from the specialized literature, some of them being characteristics of cell walls and membranes and others are found in cells as reserve compounds.

## CONCLUSIONS

Based on the results, the following conclusions were drawn:

-The management of the company which produces cheeses, in order to achieve economic growth, is very important to analyze and take decisions related to the use of starter microbial cultures which will determine increase of productivity and competitiveness,

-In the process of producing cheeses, the mesophilic starter cultures registered relevant values of homofermentative and heterofermentative microbial species.

- A well-defined fermentative metabolism was registered at the thermophilic starter cultures, charateristic to the number of fermentation bacteria.

-The fermentation processess in production of cheeses are highly influenced by mesophilic, thermophilic and mixed lactic starter cultures, playing a significant role in the production volume growth of the company.

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# E-COMMERCE AND E-CONTRACTS: CHALLENGES, RISKS AND OPPORTUNITES IN THE CROSS-BORDER MARKETS

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***Abstract***

*The popularity of e-commerce is growing more and more, being widely accepted and promoted by both consumers and businesses. The scientific investigation has the purpose to study the commercial relations which take place in the virtual environment, where people buy and sell products and services, using more and more e-contracts and e-commerce platforms. In this scientific research are analyzed types and advantages of e-commerce, the categories of e-contracts, the consent and the validity of e-contracts, the legal framework of the Republic of Moldova in the area of study and the risks related to them and the opportunities in the cross-border markets. In the research was used statistical data from the National Bank of Moldova, the National Bureau of Statistics of the Republic of Moldova and other sources. The main conclusion of the scientific analysis is that electronic contracts have a high importance in the development of the cross border markets but they generate risks which need to be managed. The main results of the scientific paper consist of the highlighting the necessity of additional algorithms, questions before signing the electronic contracts in order to reduce the risks and to be more protected.*

***Key words*****:** *e-contracts, e-commerce, legal framework, online shopping, risks*

## INTRODUCTION

The Information Technologies Sector is among the booming economic sectors, registering one of the fastest developments and growths. The sustainable economic development of a country depends primarily on its ability to effectively use information and communication technologies that contribute essentially to increasing the productivity of the labour force.

In this way, the Information Society also integrates the objectives of sustainable development, based on social justice and equal opportunities, freedom, cultural diversity and innovative development.

Contracts from the online environment and the contractual relationships that exist in the online environment have become the object of scientific researches of many scientists all over the world.

The domain of research of the present article is not very well studied, being of high interest. The article will bring more light to the domain of e-contracts and e-commerce, by the analysis performed by the authors on the risks connected to the area of study and how to mitigate them.

## MATERIALS AND METHODS

This scientific research was elaborated based on the scientific literature in the field of electronic contracts, e-commerce and the analysis of legislation of the Republic of Moldova:

-The Civil Code of the Republic of Moldova, Law no. 1107-XV of 06.06.2002;

-Law no. 284/2004 of 22.07.2004 on electronic commerce;

-Consumer Protection Law No. 105 of March 13, 2003;

-Law No. 91 of 29.05.2014 of the Republic of Moldova on electronic signature and electronic document;

-Law No. 114 of 18.05.2012of the Republic of Moldova on payment services and electronic currency;

-Law No. 133 of 8 July 2011 on Personal Data Protection, etc.

At the elaboration of this scientific paper was used the following research methods: analysis

and synthesis, induction, deduction, logical presentation of the ideas and results.

## RESULTS AND DISCUSSIONS

The development of the Internet has led to the development of a new form of commerce - electronic commerce.

Electronic commerce, in recent years, has registered an impressive upward evolution, with e-commerce sales in 2021 of about 5 trillion USD, which represents a spectacular growth, considering that this industry began to exist in 1991, when the Internet was opened for commercial purposes.

In Moldova, in 2021 the number of transactions performed through e-commerce compared to 2020 increased from 11 mln to 15 mln transaction (Figure 1).

According to Figure 2, the number of e-commerce platforms in 2021 increased by 59 platforms compared to 2020 and by 176 platforms compared to 2019.

E-commerce has its beginnings back in the 60s, being characterized by electronic technologies of transfers of funds within networks with high value added, where different data are changed electronically.

According to the studies of some authors, e-commerce represents the virtual place where suppliers meet - with electronic catalogues of products and services - with potential buyer companies, in order to exchange information, business and collaborate in order to achieve joint business [18].

In the opinion of Miron Alexandru Dumitrescu, *electronic commerce* means, in the "traditional" sense, the use within value-added networks of applications such as electronic document transfer (EDI), fax communications, barcodes, file transfer and electronic mail [7].

E-commerce, in our view, essentially means the conduct of commercial, governmental and personal activities through computers and telecommunications networks and includes a wide variety of activities involving the exchange of information, data or value between two or more parties with the involvement of electronic means.

Many scientists around the world performed researches related to e-commerce including: Clarke (1999) [6], Hoffman and Novak (2006) [8], Poon (1998), Riggins & Rhee (1998) [20], Swatman (1996) [21], Wigand (1997) [22, 23] and Zwass (1996, 1999) [25, 24] etc.

According to Figure 3, we distinguish 6 types of electronic commerce which are very well described in the professional literature :

a) *B2B (Business-to-Business) electronic commerce;*
b) *B2C (Business-to-Consumer) electronic commerce* [7];
c) *C2C (Consumer-to-Consumer) electronic commerce*;
d) *C2B (Consumer-to-Business) electronic commerce*;
e) *B2A (Business-to-Administration) e-commerce*;
*f) C2A(Consumer-to-Administration) e-commerce.*

According to the researches of several scientists, we distinguish the following models of e-commerce (Figure 1) [1, 16, 17]:

✓ *Online stores (e-stores)* – managed by a company for the marketing and sales of its own products/services. It contains a catalogue of services/products, where technical/commercial descriptions are presented for each item in the catalogue. The biggest motivation for creating e-stores is to attract a large number of customers without distance being a problem.

✓ *Electronic procurement (e-procurement)* – represents the electronic offering and procurement of goods and services. Among the benefits sought – a greater range of suppliers which will lead to lower costs, higher quality and a shorter delivery time.

✓ *Electronic auction (e-auction)* – the traditional auction mechanism is implemented with the help of the Internet. Online auctions require the existence of a real-time auction site and take place in various time periods (hours, days or weeks). Once the auction period ends, the most attractive offer receives the auctioned object.

✓ *Virtual superstore (e-mall)* – consists of a collection of small electronic stores that are united by common products, common means of payment or a well-known company name.

✓ *Business Concession (Third Party Marketplace)* – is a very common form of online store, which assumes that a company decides to leave its activities on the Internet to other companies specialized in the field, usually companies that deal with the creation and maintenance of virtual stores for the companies with which they have contracted.

✓ *Virtual Communities (Virtual Communities)* – the greatest added value of virtual communities is given by their members who add their information in a virtual environment created by the company that owns the virtual community. The purpose of creating virtual communities is to gain advantages on the market or on certain segments, to increase the loyalty of community members.

✓ *Value Chain Service Provider for e-commerce channels (Value Chain Service Provider)* – these providers specialize in certain specific functions – logistics, electronic payment, inventory production management expertise.

✓ *Value Chain Service Providers* – specialize in certain specific functions in the value chain, such as electronic payment or distribution logistics, with the aim of turning this into their competitive advantage.

✓ *Value Chain Integrators* – multimodal transport companies, travel agencies that sell services offered by third parties (transport companies, hotels).

✓ *Collaboration Platforms (Collaboration Platforms)* – contain a set of tools and information media for collaboration between companies.

✓ *Information brokerage and other services;*

✓ *Trust Services* – guarantee services for certain products/services offered by third parties (Trust Service), which increases the degree of trust of the buyer.

From the types of electronic commerce described above, in the Republic of Moldova the concept of e-store (online store) is very widespread.

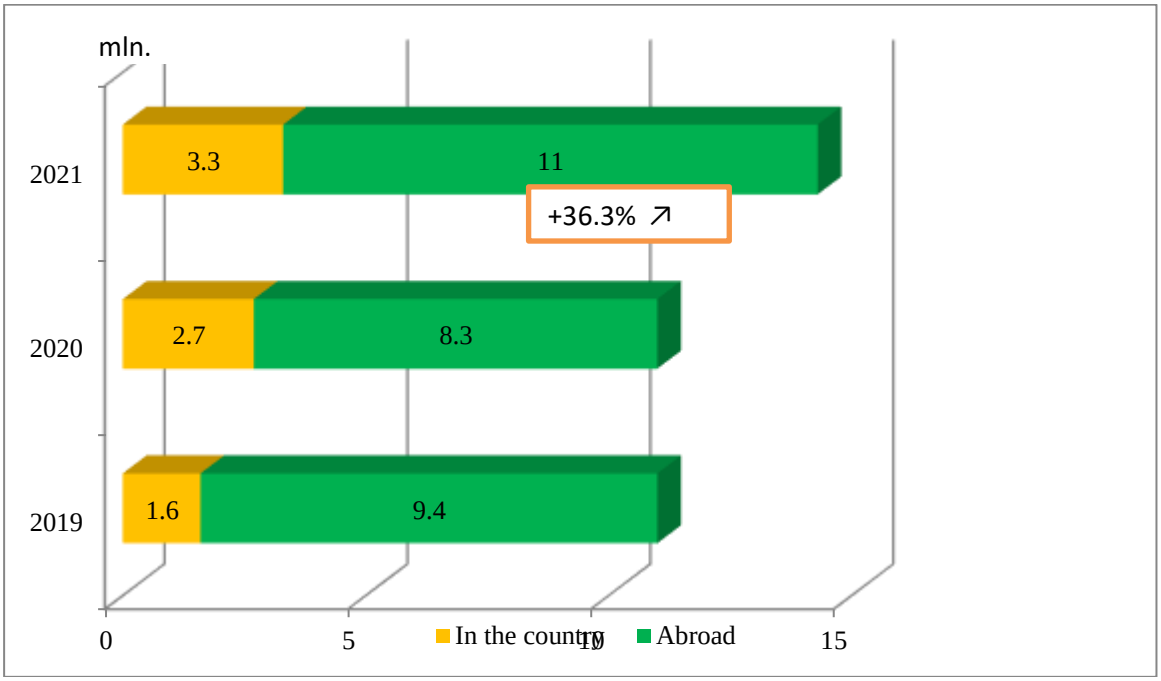


Fig. 1. The evolution of e-commerce transactions performed in banks during 2019-2021
Source: elaborate by the author based on the data from the National Bank of Moldova [15].

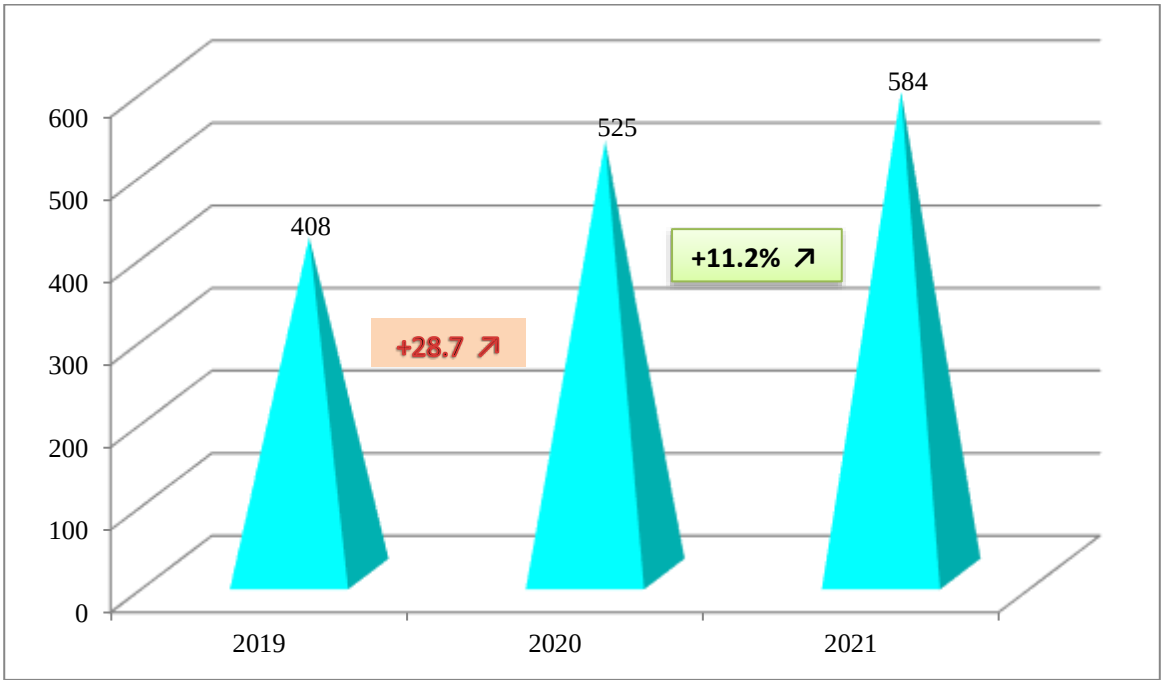


Fig. 2. The evolution of e-commerce platforms during 2019-2021
Source: elaborate by the author based on the data from the National Bank of Moldova [15].

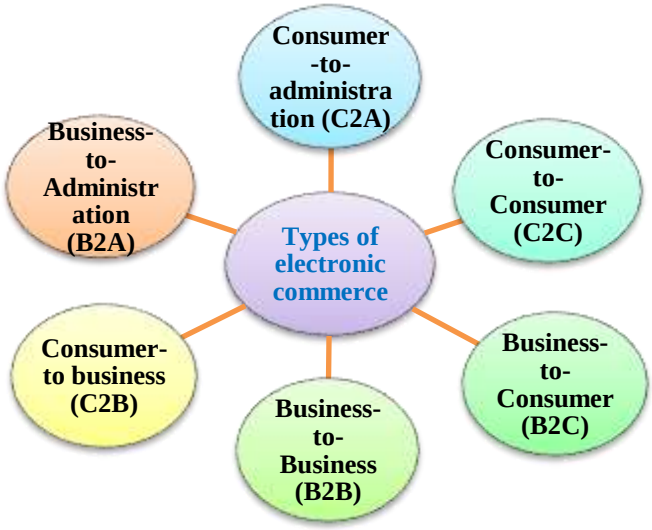


Fig. 3. Types of electronic commerce (e-commerce)
Source: elaborated by the author.

Electronic commerce in the Republic of Moldova is regulated by Law no. 284/2004 of 22.07.2004 on electronic commerce [9].

In accordance with Law no. 284/2004 of 22.07.2004, electronic commerce represents *"the entrepreneurial activity of natural and legal persons for the sale of goods, the execution of works or the provision of services, carried out with the use of electronic communications and/or electronic contracts* [9]. The provisions of the Civil Code of June 6, 2002 and the Consumer Protection Law no. 105 of March 13, 2003 [5, 10] apply to the relations between the buyer and the e-commerce agent. Also, electronic commerce is subject to all the normative acts that regulate economic activity, namely: how to register the company, keeping accounts, paying taxes and duties, labor protection, etc.

In accordance with art. 9 of Law no. 284/2004, the right to carry out electronic commerce appears with the state registration of the legal person or the individual entrepreneur, with the exception of the cases

provided by the legislation that refers to the licensing of certain types of activity.

Thus, for the registration of a legal entity, it is necessary to submit the following documents to the Public Services Agency: the application for registration; the deed of incorporation in two copies; copy of the identity cards of the founders; proof of payment of the state tax. The founders draw up the act of incorporation, which is notarized as a condition of validity. The content of the act of incorporation is described in art 247 of the Civil Code (headquarters of the legal entity, type of activity, etc.).

Once the legal entity is registered, it is necessary to select a domain name (site name), a domain type (.md), which must be registered in accordance with the law. It is very important to check if the selected domain name ".md" is available. This can be verified by accessing the website www.nic.md. The domain name is registered by addressing to Î.S. "MoldData", after which the website platform is developed and the content about the products sold is added.

In the Republic of Moldova there are a multitude of companies specialized in the creation of e-commerce sites.

In accordance with art. 9 of Law 284/2004, for the creation of a business in the online environment, it is not necessary to obtain a license, but if it is intended to sell products that fall under licensed types of activity (alcoholic products, fertilizers), obtaining a license is mandatory.

According to the definition of the *Law on electronic commerce*, we find that an essential element of electronic commerce is the use of electronic communications and electronic contracts.

By ***electronic communication*** is meant "*information in electronic form, which does not constitute an electronic document, sent, received and stored with the help of electronic means*" (e.g. fulfilling the online order and receiving the payment confirmation), and by ***electronic contract*** - "*all the electronic documents that constitute the civil law contract, aiming at the establishment, modification or suspension of certain civil rights and obligations, the object of which may be goods, works or services*".

At the same time, according to art. 882 of the Civil Code of the Republic of Moldova, the contract is the agreement of will made between two or more persons by which legal relations are established, modified or extinguished. Unlike the traditional contract, an electronic contract represents the voluntary agreement of two or more parties concluded in the electronic space of the Internet.

In art. 318 of the Civil Code of the Republic of Moldova, the legal document has an electronic form if it is included in an electronic document that complies with the legislation [2].

The legal act in electronic form has the same value as the legal act in written form, regardless of how it was signed, depending on how the parties agreed.

Table 1. The register of companies issuing electronic money to which the license of the National Bank was issued/withdrawn for the activity of issuing electronic money

| N/O | Name of the company issuing the electronic currency | Fiscal code, headquarters of the electronic money issuing company | License revocation/suspension information |
|---|---|---|---|
| 1. | **„Paymaster" SRL** | 1013600034592, 42, Aleea Gării, Chișinău, MD -2001, Rep. of Moldova | - |
| 2. | **„Paynet Services" SRL** | 1013600036596, 6, Decebal Boulevard, Chișinău, MD-2002, Republic of Moldova | - |
| 3. | **ÎM OMF „Microinvest" SRL** | 1003600053518, 12, Renașterii Naționale Boulevard, 2nd floor, Chișinău, MD-2001, Republic of Moldova | License withdrawn, according to the Decision of the Executive Committee of the National Bank no. 62 of 04.04.2018 |
| 4. | **"BPAY" S.R.L.** | 1010600040527, 23/2 of. 17A , Decebal Boulevard, Chișinău, MD-200, Republic of Moldova | - |
| 5. | **„QIWI-M"** | 1008600018031, 32 , Petricani Street, Chișinău, MD – 2059, Republic of Moldova | - |
| 6. | **„FINTECLY" SRL** | 1018600050409, 800/2, Munceşti Avenue, Apt. 19, Chișinău, MD-2029, Republic of Moldova | - |
| 7. | **Î.M. „MOLDCELL" S.A.** | 1002600046027, 3, Belgrad Street, Chișinău, MD-2060, Republic of Moldova | - |

Source: adjusted by the author based on [19].

In the sense of the legal act concluded through the use of electronic means, art. 319 of the Civil Code of the Republic of Moldova regulates the situation when the subject of law does not use the electronic signature, in cases where he procures goods online, plane tickets, reserves an accommodation online and other situations. In these cases, the legal act concluded by using electronic means, in the situation when the person did not sign with the electronic signature provided for in art. 318 of the Civil Code of the Republic of Moldova, it is assumed that the person gave his consent until he contested its existence [3, 4].

Electronic contracts can be categorized according to the scientific literature in three categories:

a) ***click wrap contract*** - It appeared during the development of information technologies in the late 20th century in the United States. The concept of "click-wrap contract" was not enshrined in law, but it was actively used by lawyers in court practice. In the scientific literature of the USA, the following definition of the concept of «click-wrap agreement» can be found: «This agreement, fully concluded in an online environment, such as the Internet, in which the rights and obligations of the parties are set out». This agreement is intended to reduce the time of concluding the contract and is used for:

✓ the establishment of conditions for downloading and using software through the Internet;

✓ the rules by which users can access the website or part of it;

✓ the establishment of conditions for the sale of goods and services online.

Next we will analyze the "click-wrap" contract features:

✓ the "click-wrap" transaction mechanism completely deprives the party of the opportunity to negotiate or make changes to the proposed terms of the contract. Such a principle was named «take-it-or-leave-it»;

✓ no paper documents, handwritten signatures or personal communication between the parties are required to conclude a “click-wrap” agreement;

✓ «click-wrap» agreements allow the offeror to conclude the maximum number of contracts with minimal economic costs;

✓ click-wrap» is equally applicable to any type of contract, as it mediates non-specific types of rights.

b) ***Shrink-wrap contract*** — or «packaging» agreement — represents the purchase of a box that contains inside a program. When opening the box, the user has two options: agree to the conditions that he will find in the box when installing the program, or return the goods to the seller.

c) ***Brows-wrap contract*** — a faster way to conclude a contract: the user is provided with a link to the text of the agreement together with the "accept agreement" window.

The electronic contracts mentioned above, signed in the absence of individuals are very sensitive and may also be subject to the risk of the consent being vitiated.

In order to reduce the risks, it is important to set filters/algorithms to ask questions related to the capacity of person to sign such kind of contracts, the age and other details. In case when there are not set algorithms to identify the consumer’s age, in case of minors the transaction is under the risk to be cancelled.

In the Civil Code it is expressly stipulated the cases when a minor can sign contract mentioned above – for example in case of low-value acts and preservation acts

In electronic commerce and electronic contracts, an essential element is the ***electronic signature.***

On 27.06.2014 was approved the Law no. LP91/2014 regarding the electronic signature and the electronic document. This law "*establishes the legal regime of the electronic signature and the electronic document, including the main requirements for their validity and the main requirements for certification services* [11]."

E-commerce takes place through payment service providers. In the Republic of Moldova, the activity of payment service providers is regulated by Law no. 114 of 18.05.2012 regarding payment services and electronic money. According to art. 5 (1) of Law no. 114/2012, the following categories of

payment service providers are distinguished [12]:

*a) banks and bank branches from other states, which operate in accordance with Law no. 202/2017 on the activity of banks;*

*b) payment companies;*

*c) companies issuing electronic money;*

*d) postal service providers operating in accordance with the Postal Communications Law no. 36/2016;*

*e) The National Bank of Moldova (hereinafter - the National Bank) - if it does not act as a monetary policy authority or as another public authority;*

*f) The State Treasury within the Ministry of Finance (hereinafter - the State Treasury).*

In Republic of Moldovam according to the art. 8 of the Law 114/2012 the payment servies are provided in the national currency, with exceptions stipulated in the Law mentioned above.

In the same time, the e-commerce can be realized in electronic currency as well as in paper currency. The money in electronic form according to the Law 114/2012 is an equivalent of the Moldovan Leu [12]. The National Bank of Moldova has the authority to issue/withdraw the licenses to payment companies [14].

Also, according to the provisions of Law no. 114 of 18.05.2012 regarding payment services and electronic money, the National Bank of Moldova keeps the public registers of payment companies, postal service providers and companies issuing electronic money, which have been issued /withdrawn/suspended the license of the National Bank for the activity of providing payment services, respectively for the activity of issuing electronic currency [19].

Analysing the table 1, we can reveal that in Republic of Moldova, there are 6 companies („Paymaster" SRL; „Paynet Services" SRL; "BPAY" S.R.L.; „QIWI-M"; „FINTECLY" SRL; Î.M. „MOLDCELL" S.A.) issuing electronic money to which the license of the National Bank was issued and 1 company (ÎM OMF „Microinvest" SRL) to which the license was withdrawn according to the Decision of the Executive Committee of the National Bank no. 62 of 04.04.2018.

In the same time, a special role in realization of electronic commerce belongs to the Law no. 133 of 08-07-2011 on the protection of personal data. According to art. (3) of Law 133/2011, *"the consent of the subject of personal data, is a manifestation of the free, specific, informed and unambiguous will of the subject of the data by which he accepts, through a statement or through an action without equivocal, that the personal data concerning him be processed* [13]."

When a person buys goods in online stores it is requested the consents from that person to process its personal data and after the buyer gives his consent to process personal data, after that the transaction is processed, meaning that the good/service is procured.

Also, it is very important to mention that in order to be an electronic merchant, it is necessary to be registered as operator at the National Center for the Protection of Personal Data. Therefore, when somebody wants to buy a good/service from a website, this persons is informed about the fact that the personal data will be used only and exclusively with the purpose and the level of security to buy the goods/services and that the data of the cards the site do not save.

We also mention that in the process of registration at Public Services Agency, the process of fiscal, statistical, medical and social registration of the legal entity will be carried out automatically. The owner of the online store will keep the accounts, issue receipts, pay taxes and fees similar to a traditional (ordinary) store.

Thus, in accordance with the performed analysis regarding electronic contracts within e-commerce, we can reveal that this is a modern way of establishing business relationships due to the advantages offered by them (there is no need to present physically while signing the contract; low transaction costs; time-saving contracts) as a result of the development of information technologies. Goods/services purchased online through e-commerce bring more advantages to the purchasers: access 24 hours to international markets just a click away distance, no time and space barriers, the customers having possibility to log in and to buy at any time of

the day or night anything they want. E-commerce is directly responsible for the competitiveness and development of national economies.

## CONCLUSIONS

The rapid development of the Internet has increasingly determined the transition from traditional businesses/stores to virtual businesses/stores and the replacement of traditional commerce with a new form of commerce – electronic commerce.

More and more people initiate online business relationships, which has a multitude of advantages: it can be accessed anywhere, anytime via computer/mobile phone or other mobile device using wireless services.

In 2021, the sales via e-commerce constituted 5 trillion USD, which represent an extraordinary increase compare to 1991, when this industry began to exist, when Internet was opened for commercial purposes.

An important role in performing e-commerce is assigned to electronic contracts, which has multiple advantages, being a relative new form of expressing the consent of parties to buy/sell products/services.

According to the scientific literature, electronic contracts can be categorized in: *click wrap contracts, shrink-wrap contracts, brows-wrap contracts.*

All mentioned electronic contracts are very sensitive, because they are signed in the absence of individuals and may be subject to the risk that the consent to be vitiated.

Thus, to reduce the risks, it is recommended, before signing the contracts, to set algorithms/additional questions to check the capacity of the person who signs the electronic contract. It is very important to be careful and vigilant in the process of signing electronic contracts.

In the light of the performed investigations we can conclude that people all over the world more and more are oriented to online stores, which have multiple advantages compared to traditional ways of performing business: new digital technologies making possible to access, store and transmit information in an increasingly simple and accessible way, electronic commerce, being directly responsible for the competitiveness and development of national economies.

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# MICROBIAL QUALITY OF RABBIT MEAT CARCASSES SOLD ON THE LOCAL AND FOREIGN MARKET

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***Abstract***

*The purpose of the scientific investigation study was the microbiological research of the quality of the domestic rabbit carcasses sold in various storage periods and temperatures and the interpretation of the data obtained according to the aspects of the microbiological quantitative values. The quality aspects of the rabbit carcasses were revealed according to the organoleptic and microbiological indices, which confirmed the quality of the rabbit carcasses after the evaluations of the quality indices and their use in the food chain. In the same time, in the scientific article was analysed the local and foreign market of rabbit meat and the main problems faced by rabbit meat producers from the Republic of Moldova.*

***Key words*****:** *rabbit carcass, culture media, organoleptic indices, bacterial microflora, local and foreign market*

## INTRODUCTION

The quality of agro-food products is very important for assuring food safety and competitiveness of agricultural products [8].
More than this, the products of animal origin play a very important role in human diet and that is why their quality should be controlled for achieving a safe and healthy consumption [6].
From a nutritional point of view, rabbit meat is an important source of energy and nutrients for humans. Due to the balanced chemical composition of substances with high biological value (proteins, fats, minerals and vitamins), superior digestibility and dietary-culinary potential, rabbit meat is an indispensable food in human nutrition. Rabbit meat contains all the essential amino acids, less collagen, myoglobin and elastin than in the meat of other animal species, it has a low calorie and cholesterol content, being particularly important for the human population [4; 15; 16; 10].
At the moment, it is considered that the world production of rabbit meat is estimated at over 1 million tons, and Spain is the third producer. Although rabbit meat is marketed and consumed worldwide, information on microbiological quality is very scarce regarding spoilage microflora, sensory quality and other physicochemical aspects of this food product [1; 3; 5].
Recent bibliographic studies determine some conceptual aspects about the microbes of rabbit meat and the types of microbiological indices characteristic of its quality [7]. For these reasons, the microbiological examination of this food product is important by identifying the presence or absence of its microbial harmfulness for consumers and the preservation capacity under the given conditions [2; 13; 12].
At the same time, rabbit meat has sanitary and economic significance, with special implications in the current conditions, when the results are generally reflected in very large batches of products. For this, a series of basic conditions are necessary regarding the collection, transport and actual examination of the food samples sent to the laboratory. Therefore, the presence of certain categories of bacteria is manifested by changes in appearance, consistency, smell and taste, sometimes specific, and their detection during the microbiological examination is important

by using the most appropriate methods for isolating the respective germs, which ultimately determine the quality of rabbit meat [7, 14; 11].

For this reason, this study continues our researches regarding meat quality control in relation to bacteriological microflora as we did before on pultry meat [9], and at present,

the main objective of this research is to analyse are the microbiological flora on the quality of the domestic rabbit carcasses sold in various storage periods and temperatures and to interoret the data obtained according to the microbiological quantitative aspects.

## MATERIALS AND METHODS

The experimental part of the work was carried out in the microbiology laboratory of the Faculty of Veterinary Medicine. Rabbit meat carcasses sold in the municipality of Chișinău were investigated as material. The carcasses were subjected to organoleptic investigations and microbiological evaluations. For this purpose, the superficial and deep microflora of rabbit carcasses was studied.

The classic microbiological methods of laboratory conduct were used for researching the microflora of the meat. For research, medium samples of rabbit meat were collected from their carcasses and microbiological quality indicators were determined, the number after bacteriological and bacterioscopic tests in order to assess the quality of rabbit carcasses sold in the Chisinau market.

## RESULTS AND DISCUSSIONS

At the global level, the production of rabbit meat increased until 2010, after which registered significant decrease according to FAO and in 2020 the production of rabbit meat constituted 893,631 tons, which is lower than in 2019 with 26,347 tons, when was registered 919,978 tons of rabbit meat.

At the global level, the biggest producers of rabbit meat are: countries from Asia – 67%; European Countries – 22%, Africa – 9.7%, America – 1.6%.

The annual world production of rabbit meat is hundreds of thousands of tons, of which: China produces 700 thousand tons; Italy – 300 thousand tons; Spain and France - 180 thousand tons.

According to the figure 1, we can reveal that the production of rabbit meat in Republic of Moldova during 2016-2020 decreased from 1,135 tons to 602 tons, with 533 tons. The market of the Republic of Moldova, is facing with a deficit of rabbit meat: the economic agents ignore the high-performing technologies maintenance and exploitation of rabbits and usefor growth the breeds with low genetic potential.

Microbiological investigations of domestic rabbit carcasses demonstrate our microbiological evaluations in the following tables and figures.

The carcasses taken in the study were evaluated according to the organoleptic indices according to the norms in force. Consistency, taste and smell were determined organoleptically: external appearance, color and cross-sectional appearance - visually, according to GOST 9959.91 "Meat products. General conditions for organoleptic evaluation" [10]. The rabbit meat samples taken in the study were analyzed from an organoleptic point of view in accordance with Government Decision no. 696/2010 regarding the approval of the Technical Regulation "Meat - raw material. Production, import and marketing". The organoleptic properties of the meat were appreciated by the indicators: color, consistency, smell, taste.

The data in Table 1 represent the results of the organoleptic assessment of fresh domestic rabbit carcasses,

Thus, according to the evaluation of the organoleptic indices of the investigated rabbit carcasses, we mention that the structure and organoleptic indices depend on a series of factors, such as: the composition of the muscle tissue, the ratio between the tissues, the processing method, the physiological state, the thermal state of the product, etc.

The results obtained state that the organoleptic indices assessed in the investigated samples correspond to the requirements of the norms in force.

Later, the values of the total number of microorganisms were determined, regarding the microflora of the samples from the rabbit carcasses, both superficially and from deep. In this context, we state that the microflora represents a sanitary indicator and provides data on the state of contamination of the product. The research was carried out according to the requirements of the Government Decision No. 221 of 16-03-2009 [11] regarding the approval of the Rules regarding microbiological criteria for food products.

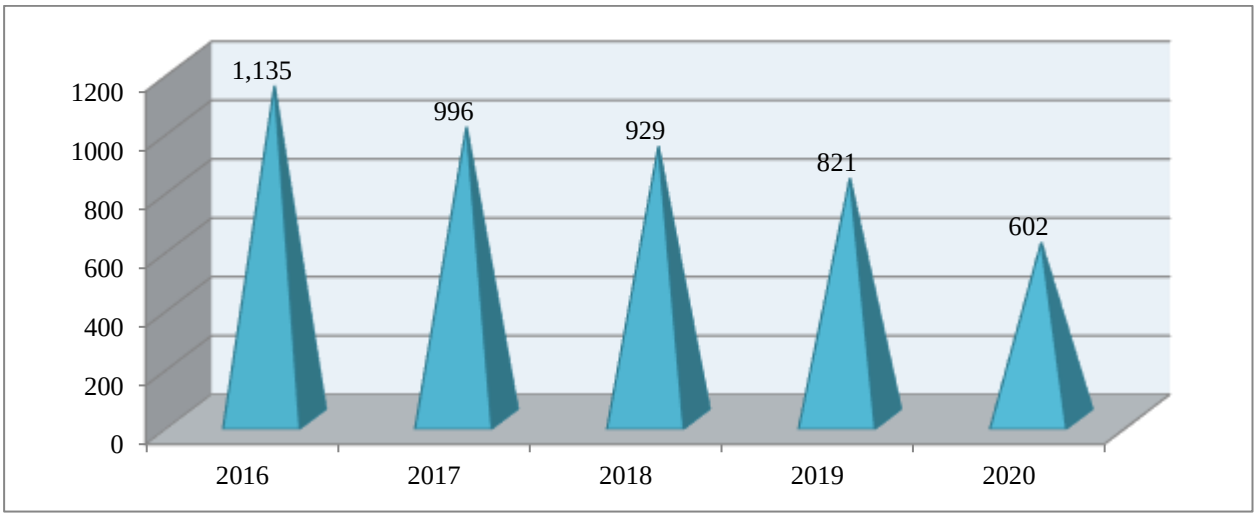


Fig. 1. The production of rabbit meat in Republic of Moldova during 2016-2020, tons
Source: elaborated by the authors.

Table 1. The study of organoleptic indices of rabbit carcass (according to Government Decision no. 696/2010)

| Organoleptic indices | Fresh carcasses |
|---|---|
| Color | It varies from pale pink to red, depending on the type of muscle |
| The smell and the taste | Species-specific, determined by the particularities of the feed, sex and species, as well as the content of ammonia and sulfur in the meat |
| Succulence | Pronounced |
| Consistency | Normal |
| Mottling | Pronounced |
| The parcelling | Medium |

Source: elaborated by the authors.

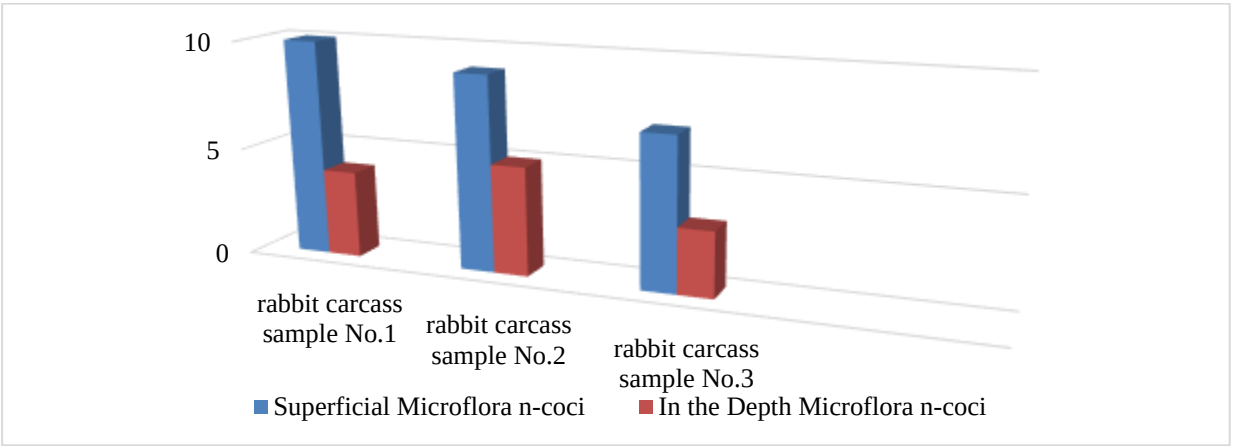


Fig. 2. Indices of bacterioscopic quality of carcass of domestic rabbits
Source: elaborated by the authors.

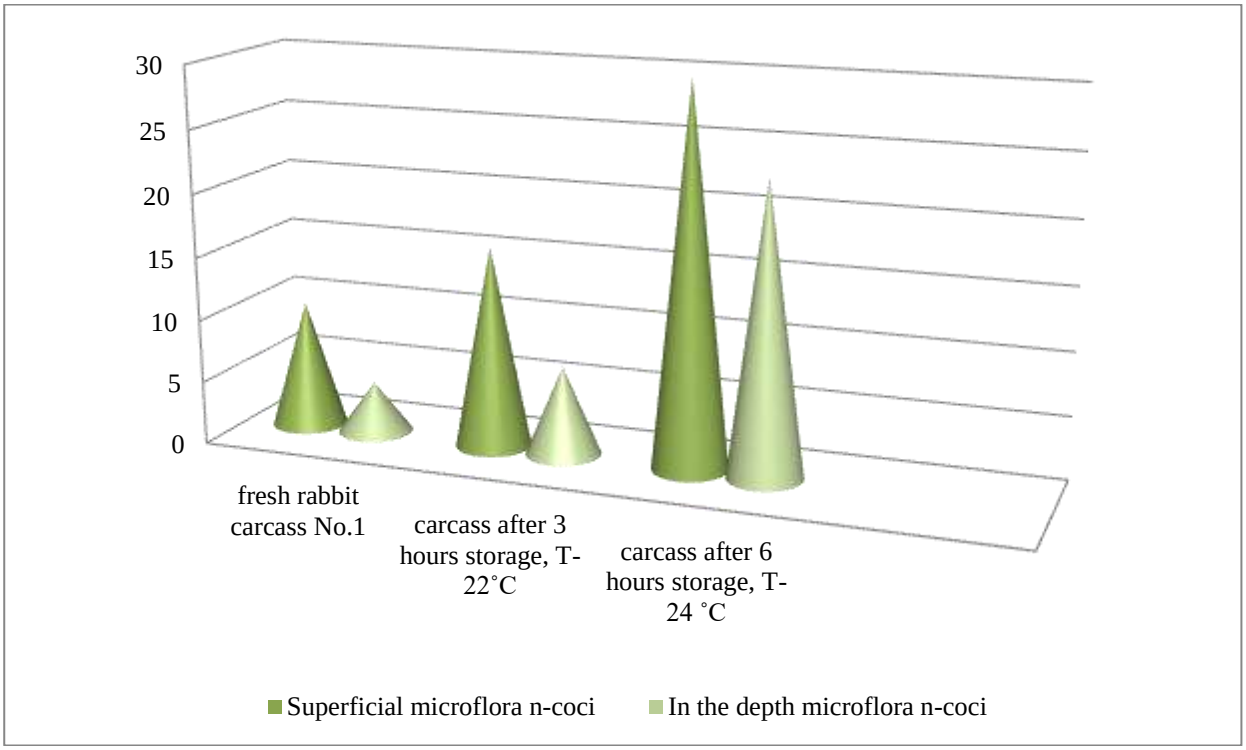


Fig. 3. Indices of the bacterioscopic quality of the carcass of domestic rabbits No. 1 in various periods of storage time and temperature
Source: elaborated by the authors.

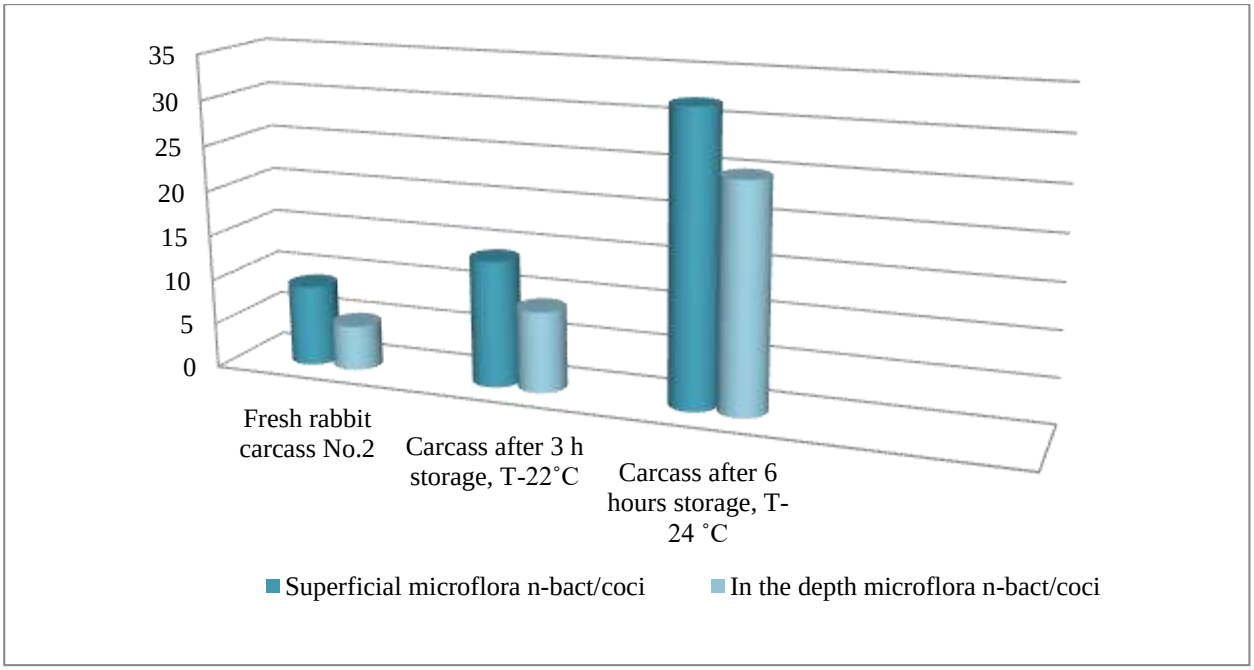


Fig. 4. Indices of the bacterioscopic quality of the carcass of domestic rabbits No. 2 in various periods of storage time and temperature
Source: elaborated by the authors.

The quality of the rabbit meat investigated according to the bacterioscopic indices regarding the evaluation of all the carcasses constituted the values of the superficial and deep microflora shown in figure 2. Thus, according to the values obtained, the indices of the superficial microflora of all the carcasses examined were higher, constituting 10; 9 and 7 saprophytic cocci bacteria at bacterioscopy, compared to the microflora indices from the depth with values of 4; 5 and 3 saprophytic cocci cells. Therefore these

values appreciate a less abundant microflora, which denotes normal aspects of development and multiplication of the saprophytic bacterial microflora.

Important aspects of the investigation of the bacterioscopic quality of the carcass of domestic rabbit No. 1 are reproduced in figure 3, where the values of the polluting microorganisms in various periods of storage time and temperature are highlighted.

The indices of Figure 3 denote values of the superficial microflora of the rabbit carcass No. 1 of 10; 16 and 30 cocci bacteria in various storage periods of 3-6 hours at different temperatures of $22^0$C and $24^0$C, compared to the microflora from the depth, where the number of saprophytic microorganisms is lower and is 4; 7 and 23 cocci microbial cells.

Later, important aspects of the investigation of the microflora of rabbit meat are shown in Figures 4 and 5, where the values of cocci microorganisms recorded in carcasses No. 2 and No. 3 constituted comparable indices in various periods of time and temperature.

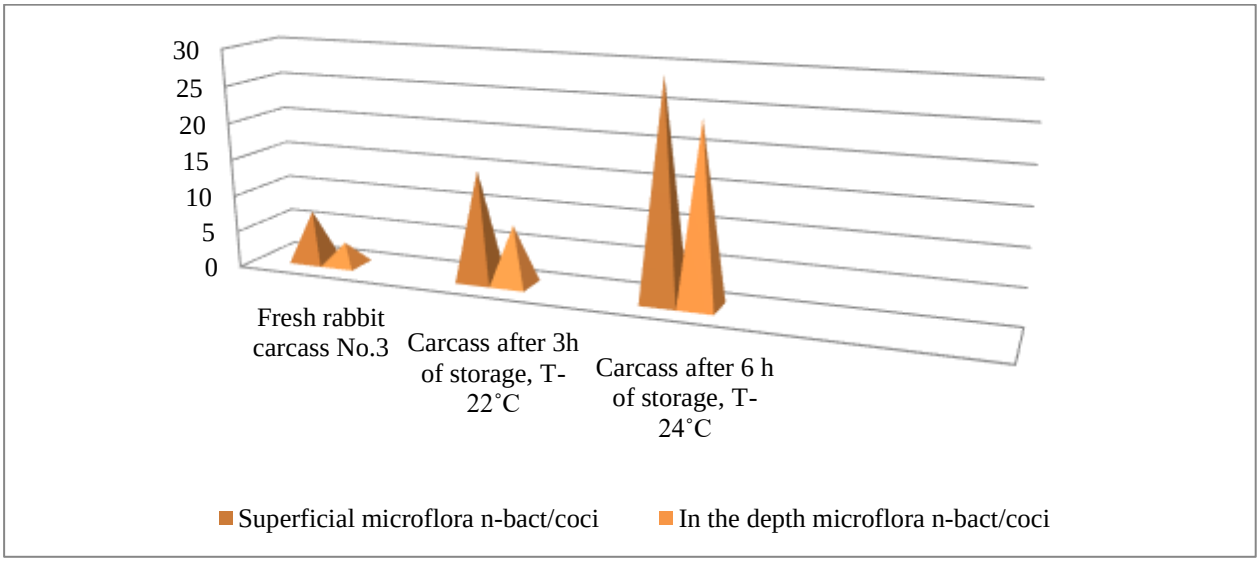


Fig. 5. Indices of the bacterioscopic quality of the carcass of domestic rabbits No. 3 in various periods of storage time and temperature
Source: elaborated by the authors.

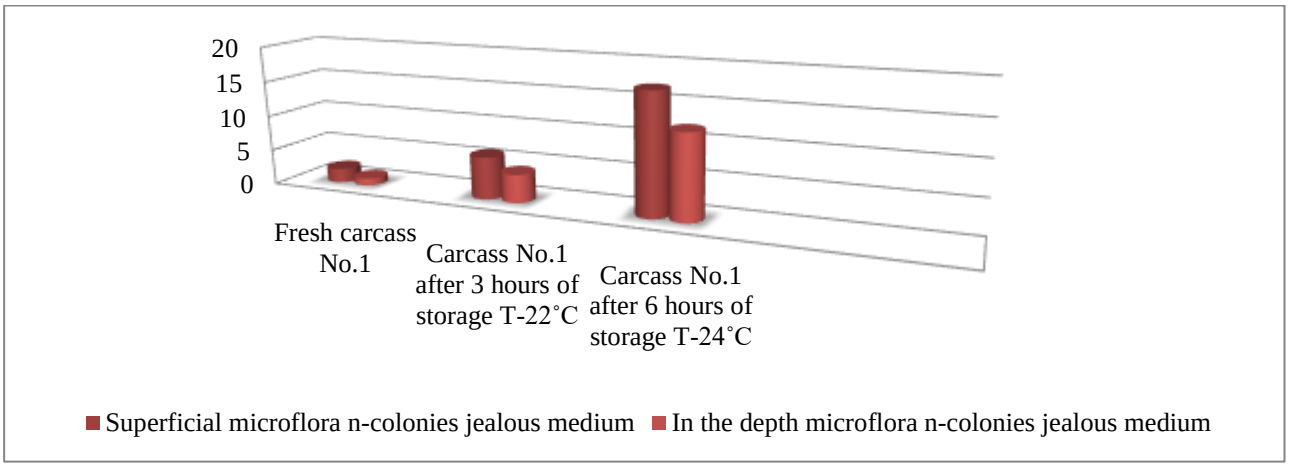


Fig. 6. Indices of the bacteriological quality of the carcass of domestic rabbits No. 1 in various periods of time and temperature
Source: elaborated by the authors.

These microbiological aspects constituted values of 9; 14 and 32 microbial cocci cells and 7; 15 and 29 of the superficial microflora after 3 and 6 hours of storage at various temperatures compared to the microflora in the depth of the rabbit carcasses, where the

microbiological values were 5; 9 and 25 cocci microbial cells, compared to values of 3; 8 and 24 microorganisms respectively in rabbit carcasses No. 2 and 3 investigated.

At the same time, the microbiological investigations, regarding the quality of the rabbit carcasses, were bacteriologically investigated on various usual jealous culture media and especially: Endo and Levine, aiming at the detection of pathogenic microorganisms of the Salmonella, Escherichia species.

Figures 6, 7 and 8 determine the results of the bacteriological quality indices of the carcasses of domestic rabbit No. 1; No. 2 and No. 3 kept for various periods of time and temperature. Appreciable values can be observed in figure 5 of the rabbit carcasses, where they constituted the investigation of the superficial microflora of the carcass No. 1 on the jealous culture medium 2; 6 and 17 microbial colonies and 1; 4 and 2 microbial colonies when investigating rabbit carcass No. 2.

Pathogenic microorganisms of Salmonella and Escherichia species were not recorded on Endo and Levine media.

Figure 7 regarding the investigations of the bacteriological quality of the carcass of domestic rabbit No. 2 in various periods of time and temperature has relevant indices of 4; 7 and 18 microbial colonies of the superficial microflora and 2; 3 and 8 microbial colonies of the microflora in depth on the usual agar medium, compared to the indices revealed in figure 7, where the indices of the bacteriological quality of house rabbit carcass No. 3 constituted 6; 9 and 21 bacterial colonies regarding the superficial microflora of the carcass and 3; 5 and 10 microbial colonies on the microbial microflora in the depth of the carcass.

Regarding the presence of the microflora of pathogenic microorganisms in these rabbit carcasses No. 2 and No. 3, Salmonella and Escherichia species were not recorded. Thus, meat being a favorable environment for the development of bacteria determines an intense development of the microflora both on the surface and in depth. Therefore, the indicators of the level of microbial load of rabbit carcasses in our opinion, can be influenced by temperature and storage time.

These reports indicate the fact that the temperature of the meat and the environment in which the meat is kept has a major role in ensuring the microbiological and biochemical stability of the meat. As a result of keeping at temperatures of $22^0$C-$24^0$C, there are correlated changes in the physico-chemical parameters.

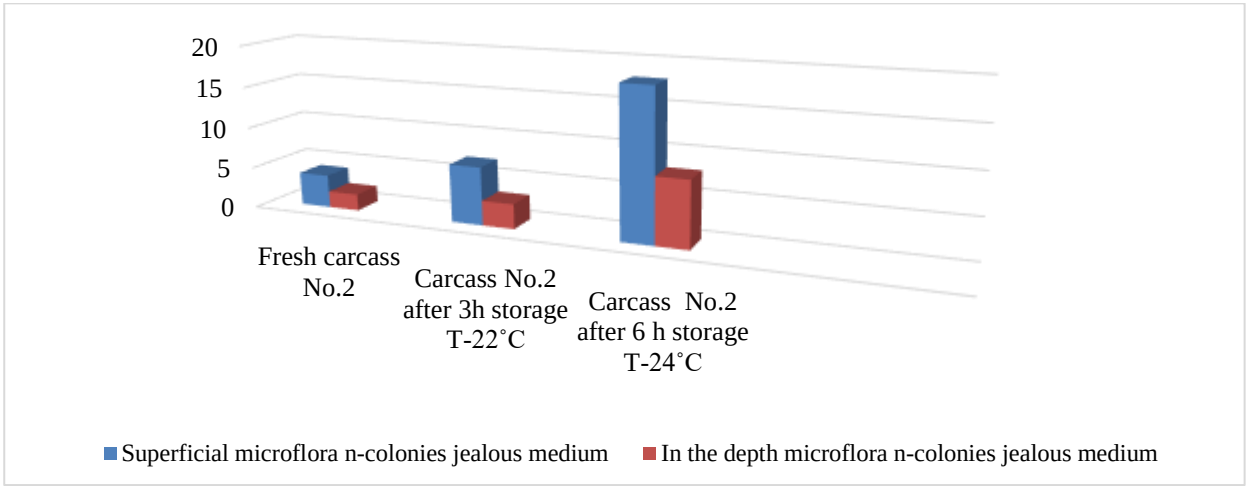


Fig. 7. Indices of the bacteriological quality of the carcass of domestic rabbits No. 2 in various periods of time and temperature
Source: elaborated by the authors.

Analyzing the study values and bibliographic sources regarding the microbiological study of the quality of the meat investigation, we were guided by some methodologies related to the division of the meat sold in three categories:

-fresh meat, where the microflora constitutes up to 10 cocci when viewed microscopically;
-less fresh meat, where the bacterial microflora constitutes up to 30 cocci per microscopy;
-relatively fresh meat, where the bacterial microflora constitutes more than 30 cocci.

In 2022 the rabbit meat has become more expensive by over ten percent, compared to last year. Thus, one kilogram ended up costing 150 lei. According to the producers, this happens because of the increase in the prices of fuel, but also of veterinary services and products.

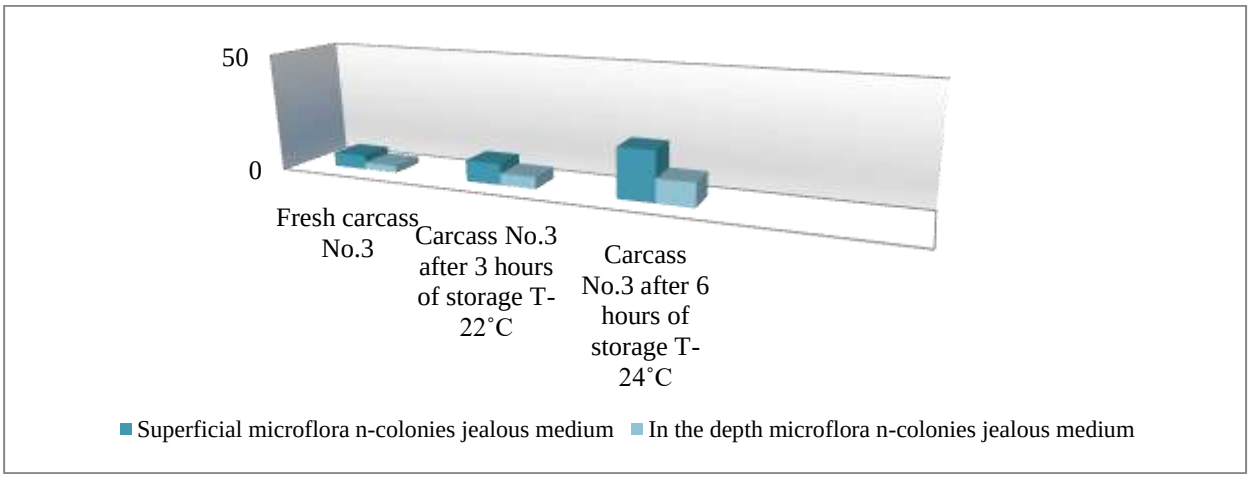


Fig. 8. Indices of the bacteriological quality of the carcass of domestic rabbits No. 3 in various periods of time and temperature
Source: elaborated by the authors.

In the same time, according to the performed investigations rabbits are grown mainly in domestic conditions and not in enterprises well organized and equipped, which determine low level of competitiveness on the market. The rabbit meat producers complaints about the tax burden, which in the country is quite high, being not friendly to the business environment. In Moldova taxes from salaries constitute 45% and the VAT rate on meat is high (20%).

At the end of the research of the microbial indices of the bacterioscopic and bacteriological quality of the carcass of domestic rabbit meat, we appreciate the absence of pathogenic microorganisms spp Salmonella, Escherichia, etc. and the presence of saprophytic microorganisms characteristic of cocci by morphology, which constitute a normal microflora of the meat.

Photo 1. Growing rabbits in domestic conditions in Republic of Moldova
Source: elaborated by the authors.

These results of the investigations allowed us to state that all categories of rabbits meat carcasses correspond to the quality indices and can be used in the food chain.

## CONCLUSIONS

The results of this research work led to the following conclusions:

-Rabbit meat presents a favorable food product for the development of biochemical and microbiological processes.

-The quality of the classic microbiological methods of rabbit meat investigation confirms the safety of its use in consumer food.

-The microbiological quality indices of the domestic rabbit carcasses taken in the study indicate their freshness according to Government Decision on microbiological standards no. 221 of 16.03.2009, regarding the microbiological criteria for food products.

-The physical factor of the external environment – temperature, influences the intensity of bacteria development, classifying this food product in the category of meat - less fresh after 6 hours of storage.

-All categories of rabbit meat carcasses correspond to the quality indices and can be used in the food chain.

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# THE POTENTIAL OF ROMANIAN WINERIES IN WINE TOURISM DEVELOPMENT

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***Abstract***

*Wine tourism in Romania is relatively a new concept that became a topic of interestin the last years. If countries such as France, Italy, Spain or Australia are already well known not only for their wine quality, but also for diverse wine tourism activities that are taking place in their most known wine regions, Romania is stillin progress with wine tourism development.The aim of this paper is to highlight the wine-growing and wine-making potential of Romania and the way it could leadto the growth of the wine tourism. From the quantitative analysis that was made in order to see where the country stands in terms of wine production, exports, imports and consumption compared with the main wine producing countries,it has been seen that Romania has a positive evolution trendandoverall, it ranks 13$^{th}$ worldwide in regard to wine production.Additionally, the second part of the analysis has shown the classification of Romanian wine regionsand the number of wineries per region, as well as the main wineries that offer wine tourism services. Considering the dimension of the wine sector, there is an orientation of Romanian wineries towards the growth of the wine tourism services, where currently Muntenia and Oltenia wine regions stand out.*

***Key words*****:** *tourism, wine sector, wine route, touristic offer, viticulture*

## INTRODUCTION

Wine tourism has become a very attractive type of tourism in many countries, and it can be confirmed by the fact that more and more research papers are being published with case studies from different wine destinations of the world. Eno-tourism is a niche type of tourism that became popular even in Romania in the last couple of years. This type of tourism is playing a significant role in both wine and tourism sectors. As per definition, the main activity related to wine tourism is the wine tasting, that takes place at the wine cellar. However, one of the most known wine tourism definitions is given by [12] that states "*wine tourism is a visitation to the vineyards, wineries, wine festivals and wine shows for which grape wine tasting and/ or experiencing the attributes of a grape wine region are the prime motivating factors fir visitors"*.

In recent years besides wine tasting, wineries owners have tried to expand their services and introduced to the list of activities at the cellar various experiences that might attract visitors. Also, the focus of the wineries owners nowadays is to improve the tourism package for the visitors and to have facilities as accommodation, catering, entertainment etc. The wine region charm is also an important motivating factor for visitors as they always have the possibility to taste wines in the proximity of their homes (restaurants, festivals or to purchase wine from the store).

[24] relates the factors that enhance the wine destinations performance, but also these could be consider as potential factors for wine tourism development as follows: good management of wine related resources, the support of tourism services, amenities and facilities, infrastructure, networking, destination image, brand identity, external factors and management of demand issues. In order to sustain these ideas, various papers were approaching the subject of wine destinations development based on case studies of wine regions from the main wine production countries.

According to [28], the focus on the development of oeno-tourism occurs from economic interests – in the last years wine production increased and this generated high profit for the winemakers and stakeholders,

therefore they started to target additional businesses that might result in greater revenue. Starting from this assumption, wine producers made progress in making plans to expand services at the wine cellar, as well as to invest in dedicated shops to sell more wine.

In the perception of [3] in order to have a sustainable wine tourism development and to improve the awareness of the wine area, it is mandatory that marketing alliances be established. In Romania there is only one wine region that has an alliance at this moment with the purpose to promote the area and to align to the same quality standards when it comes to wine production. *Asociația Dealu Mare* [1] is formed at the moment from 15 wineries with history in the area, however in the region it is a high concentration of wine cellars also known as one of the most important wine route in Romania.

The wine routes are signaled pathways that make the connection between wineries from a certain region as [16] presented in their paper. Furthermore, wine routes represent an economic advantage for the wine region as it gives the opportunity to the wine makers to organize thematic trips to the winery and to enggage with consumers [5].

In addition, wine routes might be the key enabler for the development of a wine region if it receives the support of public and private organizations [9] as it represents an oppotunity to bring in the attention of the people elements as cultural landscape, reputation of terroir [26], social and enviornmental experiences [11].

The travel experience for the wine tourism began when the wine routes were seen as tourist products. Considering this, a new area started with the scope to revive the wine region and to protect it while wine producers present to the world the wine heritage that they own [13]. The wine routes started to be recognized as touristic attractions once the wine producers invested in the developemnt of the infrastructure from the area together with other interested parties( hotels, restaurants etc.) [10]. The interest in wine routes started around 1920s in the area of Rhine Valley where people could admire the wonderful view over the vineyard, and further more wine routes were established in France, South Africa, California, Australia etc. [25].

On the other hand, in terms of what attracts people to a wine region [2] identifies that tourists may decide to visit a specific wine route based on a mix of environmental, cultural and social features as an integrated part of wine tourism industry development. To have a better perspective on the interdependence between wine tourism and wine sector, [23] define that experience is the key element that attracts people to the wine region. Wine tourism system as the author stated is split between demand and supply of the wine, meaning that wine producers should be able to create an experience to the visitors while they come in contact with the wine related products or activities such as festivals, winescapes, wine tastings etc. Also, other authors such as [4] described in their paper which are the wine experiences that have the biggest impact on customers experience, for instance wine education, tastings, wine activities, services, food pairing, cultural heritage or festivals and events that focus on wine discovery.

Additionally, [5] stated that wine producers have the opportunity to add up to their wine business new segments of activity where they offer additional goods and services with the scope to enhance the experiential value of the customers. Therefore, wine tourism contributes to the expansion of the farms and the agriculture sector from the wine regions as a primary driver.

In the light of analysing Romanian wineries with the purpose of wine tourism development, firstly the paper aims to investigate the country wine attributes compared with the main wine producing countries. Secondly, the objective is to review Romania's wine regions in order to show the high potential for expansion.

In order to reach the goals of this research, the data for the analysis was sourced from the database of OIV (International Organisation of Vine and Wine), together with relevant details extracted from various databases available on wine related websites [15, 21, 29, 30] and from the National Institute of Statistics [14].

## MATERIALS AND METHODS

In order to write this paper, the comparative method was used for the first part of the analysis and it is quantitative in nature. By comparing Romania in terms of wine production, exports, imports, vineyard surface with the main wine production countries it allowed to establish whether the country has enough potential to develop wine tourism or not.

The data was analysed with Data Analysis using indicators as: minimum, maximum, average and Descriptive Statistic tools from Microsoft Excel. Moreover, the analysed countries are also the ones with the most developed wine tourism [17].

For the second part of the research, the database has been completed with evidence acquired from various wine related websites where the classical research methodology was used.

The analysis was mostly qualitative as details and information regarding the attributes of the wine regions were extracted.

## RESULTS AND DISCUSSIONS

In terms of wine territory, according to OIV (the International Organization of Vine and Wine) Report in 2022 [15], Romania has 188,428 ha of vineyard which is around 3.1% of the total world vineyards surface area.

From the point of view of wine production, Romania produces approximately 3.1% of the wine of the world based on the available data for the year of 2022 on OIV database.

Also, Romania has a vast history in grape cultivation and wine production with viticulture dating back more than 6000 years ago; this is the one of the reasons why Romania occupies at the moment the 13th place on the top of wine-producing countries as per World Population Review (2023) [31].

In the following figures, it can be observed the evolution of wine consumption, exports, imports and production for the top ten wine producing countries and Romania in the last ten years.

The development of international trade is one of the factors that had a direct influence on the wine industry. The wine consumption increased during 1990s in Europe and America [18] and this led to growth of wine exports.

In this analysis, the maxim value of consumption was 144.5 mhl (1 mhl = 100,000,000 liters) in 2017, where the United States of Americawas leading with 32.7 mhl. France and Italywere next in top with 28.3 mhl and 22.4 mhl, while Romania had a consumption of only 4.1 mhl being on the second last place.

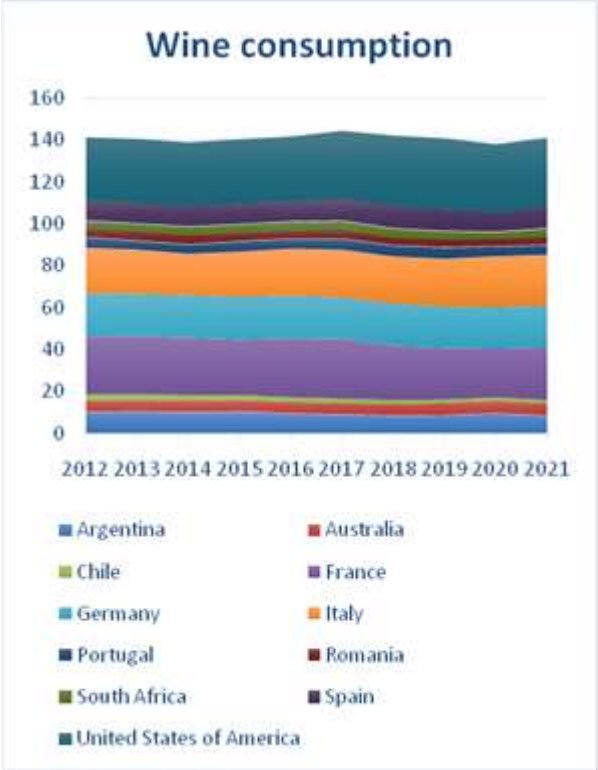


Fig.1. The countries with the highest wine consumption (Million hl /year)
Source: OIV processed information [15].

However, Romania reached the maxim value (4.7 mhl) of wine consumption in 2014, where the minimum was 3.8 mhl in 2016. An important fact to notice is that in the year of 2020when COVID-19 pandemics started the wine consumption was the lowest being only 138.1 mhl.

As a general comment over the years that were analysed the wine consumption was mostly constant with no high deviations.

The wine exports (Fig. 2) leader is Spain with 240.9 mhl in total for the years of analysis, followed by Italy with 229.6 mhl and France

with 157.8 mhl. The delta of exports volume between the three countries isquite significant and it is not directly proportional with the wine production.

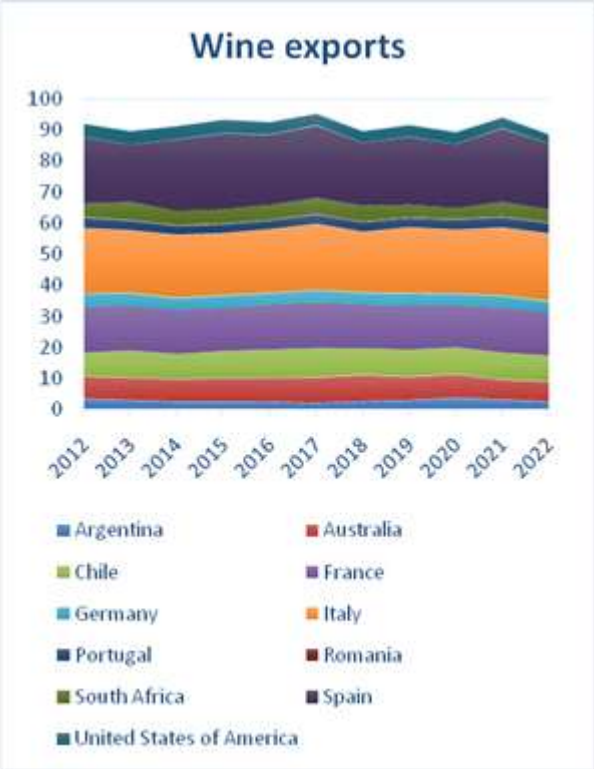


Fig. 2. The top wined exporting countries in the world, Wine exports (Million hl/year)
Source: OIV processed information [15].

Romania's exports are very low, only 1.8 mhl in total between 2012 – 2022 being the last one from the evaluated countries [6, 7].
Also, the delta between Romania and the second to last ranked country (Argentina) is 30.9 mhl which issubstantial considering the other countries results. Romania's exports started growing slowly since 2017, while the overall trend was a small decrease in 2018, 2020 and 2022 compared with the other years where the exports were above 90.0 mhl.
In addition, the imports (Fig. 3) were constant with values between 39 – 43 mhl, where the highest volume was in 2021. The biggest importer is Germany with a total of 163.8 mhl over the chosen period, followed by the United States of America – 132.2 mhl. On the other hand, Argentina, Chile, South Africa and Australia have a low rate of wine imports. In case of Romania, the volum of imports is 5.1 mhl that places it in the middle.

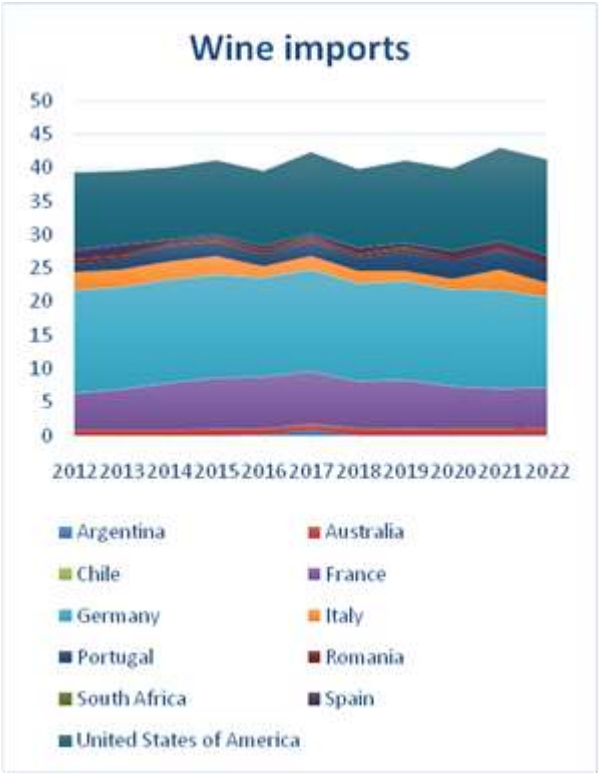


Fig. 3. The top countries with the highest wine Wine imports (Million hl/year)
Source: OIV processed information [15].

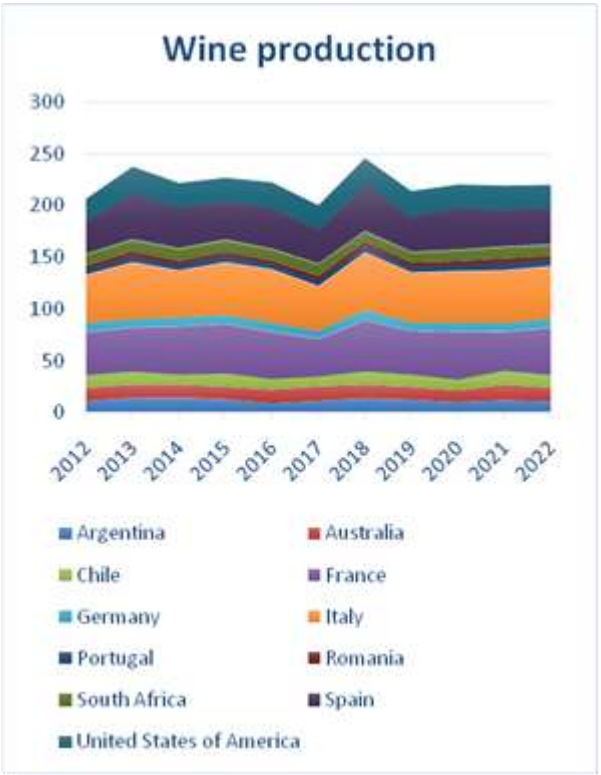


Fig. 4. Wine production in the top producing countries ( Million hl)
Source: OIV processed information [15].

However, it is important to notice that Romania imports 2.8% more wines than it

exports having the same trend as the United States of America and Germany versus the rest of the countries where the volume of exports are significantly higher than imported wines, while Portugal it is almost balanced.

For the wine production (Fig. 4) year of 2018 was the most productive with a total of 246.1 mhl across countries, while the year before it reached the minimum – 200.4 mhl.

Italy (538.75 mhl) was the leader in terms of wine production during these years followed by France (481.25 mhl) and Spain (416.81 mhl).

The wine production of Romania during 2012 – 2022 was 44.95 mhl, that results in only 4% exports from the total production which ranks it last compared with rest of analysed countries.

In contrast, Chile has the biggest rate of exports with 73% of the total wine produced, while Australia and Spain export as well more than 50% from their total wine production.

Table 1. Descriptive statistics for wine production between 2012 – 2022

| Country | Mean | S.D. |
|---|---|---|
| Argentina | 12.62 | 1.81 |
| Australia | 12.57 | 1.04 |
| Chile | 11.71 | 1.44 |
| France | 43.75 | 4.08 |
| Germany | 8.75 | 0.70 |
| Italy | 48.98 | 3.80 |
| Portugal | 6.52 | 0.42 |
| Romania | 4.09 | 0.66 |
| South Africa | 10.58 | 0.59 |
| Spain | 37.89 | 4.74 |
| USA | 24.15 | 1.32 |

Source: OIV processed information [15].

In Table 1, it is shown the mean of the total wine production for the chosen period, considering the standard deviation most of the countries produced a constant quantity of wine, while the biggest producers such as Spain, France and Italy had sharp deviations in terms of wine production throughout the time.

Furthermore, regarding vineyard surface (Fig. 5) over the years a drop for most of the nations can be observed. Due to the fact that Spain, France and Italy have the largest vineyard surface, thus these countries have also the biggest production in terms of volume. In this perspective, Romania's vineyard surface has slowly decreased starting with 2012.

Moreover, it is important to notice that Romania has greater vineyard surface than Australia and Germany.However, these 2 countries havea higher wine productioncompared with Romania.

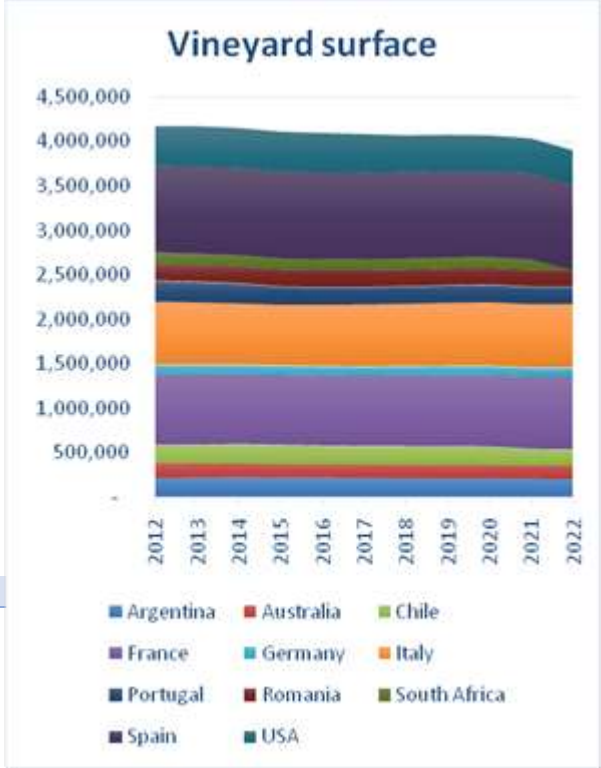


Fig. 5. Vineyard surface in various countries (ha)
Source: OIV processed information [15].

On the other side, wine producing countries are divided into two worlds: Old World ( e.g. France, Italy, Spain, Portugal, Germany, Romania etc.) and New World (e.g. the United States, Australia, South Africa, Argentina etc.) [27]. Hence, as a result of the above split we can notice that the top performing wine producing countries are a mix between Old and New worlds.

In connection to the above analysis where Romania was compared with the primary wine producing countries, we will continue the second part of the analysis with the description and attributes of the main wine regions of the country.

The main wine regions of Romania are Transylvania, Banat, Dobrogea, Moldova Hills, Maramureș, Crișana, Muntenia and

Oltenia. The wine-growing areas of Romania are also divided in sub-regions as can be seen in Figure 6, with different climatic conditions allowing to the producers to cutivate various types of grapes (Table 2), thus resulting in a very diverse wine offer [29].

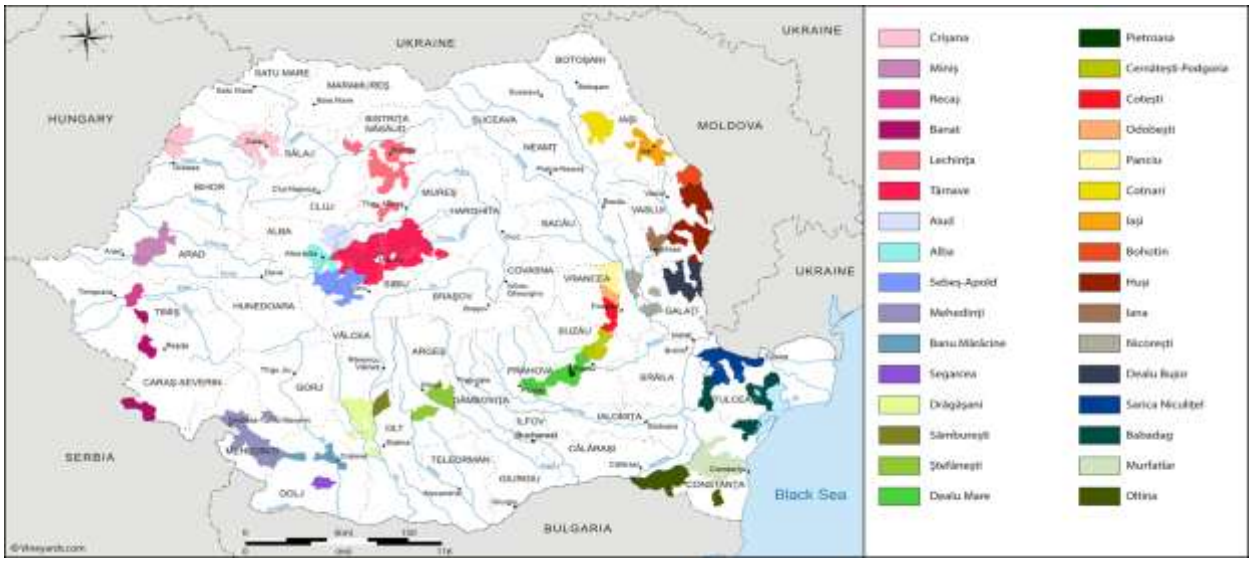


Fig. 6. The wine map of Romania
Source: https://vineyards.com/wine-map/romania [32].

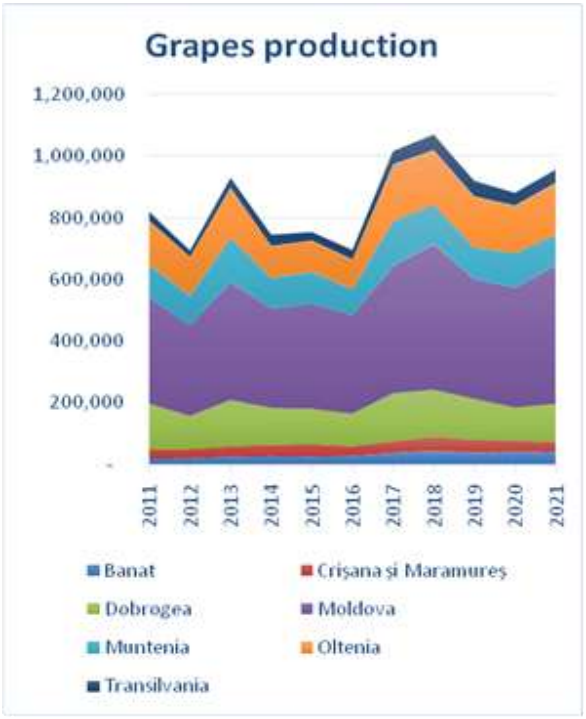


Fig. 7. Grapes production in Romania (tonnes)
Source: INSSE processed information [14].

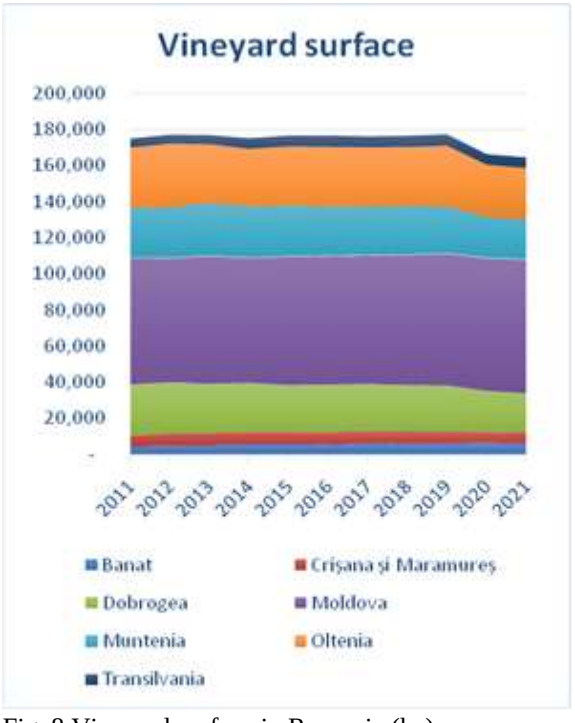


Fig. 8 Vineyard surface in Romania (ha)
Source: INSSE processed information [14].

In the Figures 7 and 8, we may examine Romania's potential in terms of wine production. Moldova region has the largest share of the cultivated vineyard area, holding 41% of the total in the country, while in terms of grape production this wine region sums up 44% from the total.

Furthermore, as can be seen in Table 3, Moldova is the wine region with the most wineries (around 118 locations), and also in the region there are two research and development stations for vinification and viticulture.

The evolution of the grapes production for the chosen period was mostly constant, except during 2017 – 2019, where after a significant increase in 2017 and 2018, in 2019 there was a sharp drop, while the vineyard surface did not have considerable changes.

Oltenia holds 19% of the total vineyard surface with no considerable deviations for the analysed period, while Muntenia with 15% of the total vineyard surface has a harsh drop of cultivated area in 2020.

Regarding grapes production, Oltenia has substantial variations during the years with multiple declines.

While in 2016 reaches the minimum production from the analysed years, in 2017, it recovers fast and reaches the maximum grape production.

Table 2. Wine regions distribution in Romania

| | Wine regions | | | | | | |
|---|---|---|---|---|---|---|---|
| | Wine region of Banat | Wine region Colinele Dobrogei | Wine region Crișanei and Maramureșului | Wine region Dealurile Moldovei | Wine region Dealurile Munteniei and Olteniei | Wine region of Podișului Transilvaniei | Wine region Terasele Dunării and alte terenuri |
| **Wine regions with Designation of Origin (DOC)** | DOC Banat, Doc Recaș | DOC Murfatlar, DOC Babadag, DOC Adamclisi, DOC Sarica Niculițel | DOC Crișana, PDO Minis | DOC Bohotin, DOC Cotnari, DOC Dragășani, DOC Huși, DOC Iana, DOC Iași, DOC Nicorești, DOC Pancia, DOC Cotești, DOC Dealu Bujorului, DOC Odobești | DOC Dealu Mare, DOC Ștefănești, DOC Pietroasa, Sâmburești, DOC Banu Mărăcine, DOC Mehedinți, DOC Segarcea, | DOC Aiud, DOC Alba Iulia, DOC Lechința, DOC Sebeș Apold, DOC Târnave | DOC Insurăței, DOC Oltina |
| **Wine regions with geographical indications (IG)** | IG Viile Carașului, IG Viile Timișului | IG Colinele Dobrogei | IG Dealurile Sătmarului, IG Dealurile Zarandului, IG Dealurile Crișanei | IG Dealurile Moldovei, IG Dealurile Vrancei | IG Dealurile Olteniei, IG Vin spumant Dealurile Munteniei, IG Dealurile Munteniei | IG Dealurile Transilvaniei | IG Terasele Dunării |
| **Main grape varieties** | Chardonnay, Fetească albă, Fetească regală, Muscat Ottonel, Pinot gris, Riesling, Tămâioasa românească, Viognier | Aligoté, Chardonnay, Crâmpoșie, Fetească albă, Fetească regală, Muscat Ottonel, Tămâioasa românească, Fetească neagră, Merlot, Pinot nour, Syrah | Chardonnay, Fetească albă, Fetească regală, Muscat Ottonel, Mustoasa de Maderat, Tămâioasa românească, Cabernet Sauvignon, Fetească neagră, Merlot, Pinot nour, Syrah | Aligoté, Băbească, Chardonnay, Crâmpoșie selecționată, Fetească albă, Fetească regală, Galbena de Odobești, Grasa de Cotnari, Muscat Ottonel,Tămâioasa românească, Busuioacă de Bohotin, Fetească neagră, Merlot, Syrah | Aligoté, Chardonnay, Crâmpoșie selecționată, Fetească albă, Fetească regală, Grasa de Cotnari, Muscat Ottonel, Riesling, Tămâioasa românească, Busuioacă de Bohotin, Fetească neagră, Merlot, Nebbiolo, Negru de Dragășani, Syrah | Chardonnay, Fetească albă, Fetească regală, Muscat Ottonel, Pinot gris, Riesling, Cabernet Sauvignon, Fetească neagră, Merlot, Pinot nour, Syrah, | Aligoté, Chardonnay, Fetească albă, Fetească regală, Muscat Ottonel, Pinot gris, Tămâioasa românească, Traminer roz, Babeasca neagră, Fetească neagră, Merlot, Pinot noir, Syrah |

Source: www.oniv.ro processed information [21].

On the other side, Muntenia's grape production is in line with Oltenia in terms of variation, 2016 being the year of a major fall, and2017 the year of significant recovery reaching the maximum production for the chosen period. With reference to wineries, Muntenia has a larger number than Oltenia, being almost doubled. Also,in this area there are located six research and development stations for horticultural, viticulture and vinification, distributed equally between the two wine regions.

Dobrogea follows in regard to vineyard surface being the fourth in line of the total in Romania, while for the grape production touches 15% from the total production. The fact to notice is that even Dobrogea has less cultivated area than Muntenia, its grape production is bigger with around 2.4%. Wineries in Dobrogea wine region also include the places located in Terasele Dunării, and from the total number it has also a research and development station for vinification and viticulture.

Grape production in Crișana and Maramureș wine region had during the years many deviations also with sharp increase from 2017 to 2018, as well as significant drops in the last years due to the decrease of the vineyard surface. Even tough this wine region has only 4% of the total vineyard surface of the country, in the area there are numerous wineries and a research and developmnt station for viticulture and vinification. On the other side, Banat is the wine region with the lowest vineyard surface with no meaningful deviations over the chosen period, at the same time the grape production had an upward trend starting with 2017. In terms of wineries, in the area there are few and no institute or station for research and development for grape cultivation.

Vineyard surface of Transilvania had no big variations during the analysed period, while in regard to grape production the region achieves between 2017 – 2019 its biggest harvest, starting to drop in 2020. In the wine region of Transilvania there is SCDVV Blaj one of the research and development station for viticulture and vinification and various wineries across.

Furthermore, based on the wine region in Romania the wines are classified as Designation of Origin (DOC) and Geographical Indication (IG) [20].

In connection with the classification, on the etiquette of the wine bottle we can find this detail; also this repesents an attribute of the wine quality.

In Table 2 it is shown that all the wine regions from Romania have both areas classifed as DOC and IG, and the main grape varieties that are cultivated can be identified. Moldova is the area with the biggest number of DOC areas and has also various grape varieties cultivated, both native and international. As per the vineyards surface proportion, Oltenia and Muntenia are the regions with numerous DOC and IG areas and a great variety of cutivated grapes, while therest of the wine regions have almost the same number of areas classifed as DOC and IG. With reference to grape varieties it can be identified that in all the wine regions there are cultivated native varieties such as Fetească alba, Fetească regală, as well as some varieties that can be found in only few areas (e.g. Mustoasa de Măderat, Crâmpoșie).

With refrence to the number of wineries in each wine region, as per Wines of Romania (n.d.) almost 500 wineries are active in the country. In Table 3 we can see the number of wineries that are mentioned on the website, and the number of wineries that have wine tourism services available to bookon the online platform winetourism.com.

Table 3. Number of wineries per wine region

| Wine region | No. of wineries | Wineries with tourism services |
|---|---|---|
| Banat | 19 | - |
| Crișana and Maramureș | 61 | 1 |
| Moldova | 120 | 1 |
| Muntenia and Oltenia | 137 | 10 |
| Transilvania | 47 | 1 |
| Dobrogea | 39 | 2 |

Source:www.winesofromania.com/www.winetourism.com processed information [30].

Table 4. Wine tourism offer

| Wine region | Vineyard | Winery | Service type | Price (EUR) | Duration | Tasted wines | Wine types |
|---|---|---|---|---|---|---|---|
| Muntenia and Oltenia | Stefănești | Azuga Rhein Wine Cellar | Wine tasting and tour | 23 | 60 min | 3 | White/Sparkling |
| Muntenia and Oltenia | Dealu Mare | Basilescu | Wine tasting and tour | 18 | 95 min | 4 to 6 | Red/White/Sweet |
| Muntenia and Oltenia | Dealu Mare | Davino | Wine tasting and tour | 23 | 60 min | No data | No data |
| Muntenia and Oltenia | Dealu Mare | Lacerta Winery | Intensive/Basic wine tasting and tour | 12 to 16 | 90 min | 4 to 6 | Red/White/Sweet |
| Muntenia and Oltenia | Dealu Mare | Domeniile Sahăteni - Winery | Wine tasting and tour | 25 | 90 min | 4 to 6 | Red/White/Rose |
| Muntenia and Oltenia | Dealu Mare | Vitis Metamorfosis - Winery | Premium/Basic wine tasting and tour | 20 to 25 | 120 min | 7 to 10 | Red/White/Rose |
| Crișana and Maramureș | Silvaniei | Carastelec Winery | Wine tasting and tour | 15 | 95 min | 7 to 10 | Red/White/Sparkling |
| Muntenia and Oltenia | Mehedinți | Catleya Wine-Estate | Wine tasting and tour | 20 | 90 min | 4 to 6 | Red/White/Rose |
| Dobrogea | Murfatlar | Crama Histria | Premium/Basic wine tasting and tour | 12 to 16 | no data | 4 to 6 | Red/White/Rose |
| Muntenia and Oltenia | Dealu Mare | Domeniile Franco-Române | Wine tasting and tour | 19 | 90 min | 4 to 6 | Red/White/Sweet |
| Dobrogea | Sarica Niculițel | Măcin Winery | Wine tasting and tour | 10.25 | 120 min | 1 to 3 | Red/White/Sweet |
| Transilvania | Aiud | Domaine Takacs Winery | Wine tasting | 8 | 90 min | 4 to 6 | No data |
| Moldova | Galați | Crama Annwine | Visit and tasting | No data | 30 min | 1 to 3 | Red/White |
| Muntenia and Oltenia | Mehedinți | Crama Oprișor | Wine tasting | No data | 30 min | No data | Red/White/Rose/Sweet |
| Muntenia and Oltenia | Cotești | Crama UNU | Wine tasting and tour | No data | 90 min | No data | Red/White/Rose/Sweet |

Source: www.winetourism.com processed information [29].

Moreover, in table4it can be identified the wineries that have already in place wine tourism services as per the wine region. These wine tourism packages are sold online by winetourism.com, an online platform that promotes wine tourism from all over the world. On this website people can choose the location where they want to go, and the platform is showing the available services for the chosen location. In Romania's case after

the search, 15wineries are listed with the type of activities that they offer, the price and the duration of the activity. Primarily Muntenia and Oltenia wine region is the area that has the most places listed, while the rest of the wineries are from Dobrogea, Moldova or Transilvania.

In regard to the service types the main activity is wine tasting and winery tour, while some wineries are offering also premium wine tastings that consists in a larger number of tasted wines.

Most of the wine tastings includes four to six wines from all the wine types produced (red, white, rose or sparkling wine). The price for such an activity is between 10 to 25 euro per person where the tour and the wine tasting lasts for about 80 minutes on average.

## CONCLUSIONS

From the wine industry perspective, the stage of development of each country is different, as the variations between wine production, exports, imports and consumption are quite significant.

Overall, currently Romania does not stand out with considerable volumes compared with the main wine producing countries for the chosen period, however it ranks 13$^{th}$ worldwide on the wine production. Thus, it can be concluded based on Sigala (2019)wine performance factors that Romania needs improvements in regard to good management of wine related resources. Nevertheless, it was seen that in terms of wine exports the country has the lowest rate versus the others nations which should be a focus point in the future in order to increase the exports to create greater visibility on the wine market worldwide.

In terms of vineyard surface, in Romania compared with rest of the countries it can be seen that the country has a trend of growth over the analysed period and a great potential for development as it was seen that the wine regions are very well delimited.

From the second part of the analysis, it is clear from the evidence that Moldova has a great potential for wine tourism development in the future years, not only because it has the biggest vineyard area and due to the fact that it is the main wine producer of the country, but also because in the area there is a significant number of wineries. In spite of that, as seen Moldova at the moment does not have many wineries that offer wine tourism services, thus this could be a segment to develop in the future in order to expand their businesses. The wine regions that currently have the most wineries that promote their wine tourism services online are located in Muntenia and Oltenia.

Furthermore, Romanian wine industry showed a huge potential of expansion, taking into consideration the regulation of the protected wine areas that guarantees for a qualitative wine, that puts the country together with the biggest wine producers of the world .As illustrated, each wine region has a considerable number of wineries that could be visited. Even tough, on the online platforms there are only a few wineries that offer wine cellar tours and wine tastings sold by third parties, if the people are interested in a specific winery, they could further search more details online about wine tourism services. In regard to wine destination performance factors, Romanian wine tourism needs support for tourism services, amenities and facilities to provide the services and a strong destination image in order to promote the wine regions.

To conclude, the rise of Romanian wine sector must keep the direction of expansion and improvement in order to sustain the development of wine tourism.

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# PROFITABILITY OF PRODUCTION OF TABLE GRAPES IN REPUBLIC OF MOLDOVA

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***Abstract***

*Viticulture for table grapes is a branch of the agro-industrial complex, which possesses high adaptability to environmental conditions, relatively simple care and high economic efficiency, etc. For each economic agent, economic efficiency expresses the need for existing factors of production to be used under conditions of economic rationality, which means that unlimited needs are satisfied with increasingly limited resources throughout the economy. This paper presents the economic efficiency of table grape production. We can state that any economic activity must produce useful and qualitatively superior effects, satisfying the principle of rationality applied to the present time and to the future, thus ensuring the prerequisites for future efficiency. The research was carried out on the basis of data from the National Bureau of Statistics and reports from the Ministry of Agriculture and Food Industry, using methods of analysis, synthesis, tabulation and graphics. The vitivinicultural sector is and will remain an important one for the Republic of Moldova. High-quality grapes and wine are the calling card of our country, recognized internationally. Dynamically, in the years 2010-2018, the viticultural sector registered an average annual increase of 6.2% - the productivity of the vineyard per fruiting; 8.4% - the harvest of table grapes; 7.1% - export of table grapes.*

***Key words*****:** *viticulture, table grapes, return, economic efficiency, Republic of Moldova.*

## INTRODUCTION

At the base of any economic activity is a fundamental economic principle – *the principle of efficiency*. The general meaning of the concept of efficiency, which can refer to an activity, person or object, is to have the quality of producing the intended useful effect. This means that, the effect obtained from carrying out some economic activities, represented by income, must exceed the effort represented by expenses so that it is possible to obtain a profit [6].

*Economic efficiency* is an economic category, which expresses, in a broad sense, the ratio between the efforts made and the results obtained. In agriculture, economic efficiency takes on a complex character, because agricultural production is characterized by a wide variety of resources, which can be put to use in various combinations, but with different results. Increasing economic efficiency in agriculture, being an objective necessity, represents, in fact, the main lever through which this branch of material production can increase its contribution to increasing national income [2; 6; 20; 10].

In the conditions of the market economy, the producer organizes his production activity based on the principles of the law of value, demand and supply, competition, and takes into account, first of all, the interests of the buyer, bears responsibility for the quality and quantity of production. All activities are based on *economic efficiency*.

The authors V. Svobodin and M. Svobodina (1999) highlighted the following types of efficiency, technological, economic and social, noting that the technological one characterizes the use of production resources, the economic one characterizes the level of realization of production relations and the social one characterizes the development of the rural and social-territorial community [18].

All the innumerable categories of efficiency are interrelated in the Fig. 1.

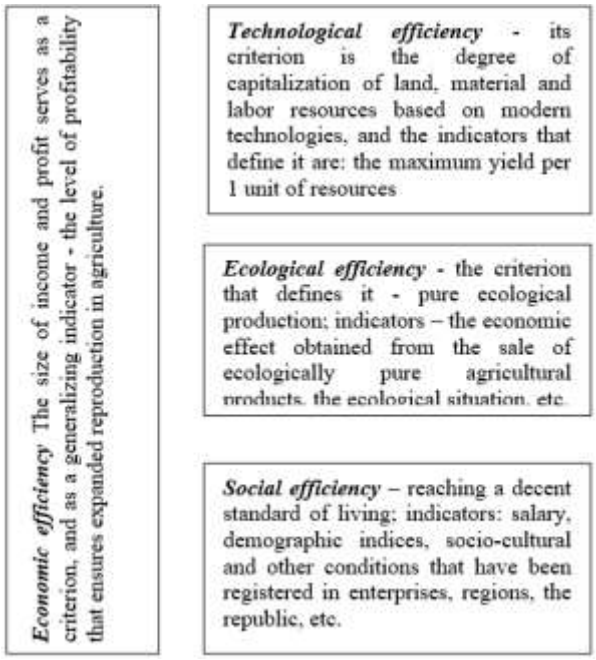


Fig. 1. The model of the structural components of agricultural production efficiency
Source: [18].

In this context, the purpose of the paper is to determine the profitability of grape production. Because, the productivity of viticultural plantations and the sustainability of their exploitation depends on the biological value of the planting material, the correctness of the establishment of the plantation and the level of care in the first 3-4 years after planting. According to the Law of Vine and Wine no. 57-XVII of March 10, 2006 (article 8, paragraph 3) the establishment of viticultural plantations is carried out with the virus-free viticultural planting material of the authorized biological category and not only of the "standard" category [12].

## MATERIALS AND METHODS

In this article we will focus on the determination and argumentation of economic calculations, regarding the economic efficiency of the production of table grapes in the Republic of Moldova.
The informational support of the research is the scientific literature devoted to the agricultural sector, the materials of the National Bureau of Statistics of the Republic of Moldova, the data collected from the Statistical Yearbook of the RepublicMoldova; The reports of the National Vine and Wine Office, specialized literature.
This problem was addressed in the works of foreign and domestic scholars such as: Babii L. (2005), Timofti E. (2009), Nicolaescu Gh. et al (2015), Zbancă, A., Morei, V., Stratan, A. (2010), Timofti and Popa (2009), Bajura T., Stratan A. et al. (2021), Timus A., Luchian, I.(2010) [1; 3; 14; 20; 21].
The following research methods were used: monographic analysis method; statistical observation; grouping method; graphic method; comparison etc.

## RESULTS AND DISCUSSIONS

For the Republic of Moldova, viticulture and wine are a visiting card, and winemaking has a rich history, which has deep roots in human history. One of the profitable branches of the agro-industrial complex is the viticulture of table grapes. Despite all the economic crises that have occurred in the economy of the Republic of Moldova, the vine growing sector and, in particular, the production of table grapes, remains a pillar sector of phytotechnics within the entrepreneurial and individual economic activity in the country (Fig. 2) [11].

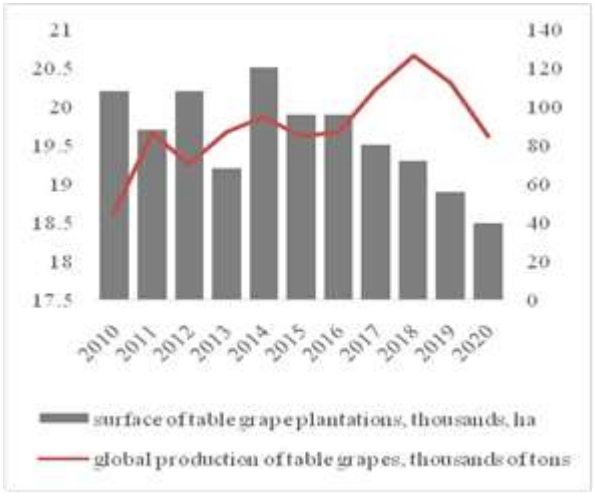


Fig. 2. Trends in table grape vine cultivation
Source: Elaborated by the author, according to data from the National Bureau of Statistics [13;17].

Viticultural plantations with table varieties have a share of about 15% in the structure of viticultural plantations in the Republic of Moldova. In the last 10 years, the dynamics of

the establishment of viticultural plantations has decreased, but that trend does not refer to plantations with table grapes, due to the growing demand of consumption on the domestic and foreign markets. The share of table varieties in 2017 represented approximately 70% of the structure of newly established plantations, or approximately 16 thousand ha of viticultural plantations of table varieties on fruit [19].

According to estimates, the dynamics of export and import of table grapes, the share of retail trade networks in total fruit and vegetable sales in the Republic of Moldova has reached the level of about 30%, at the same time registering an annual increase in sales of approx. 5-7% [9; 10].

For the analyzed period 2010-2017, the balance of international trade in grapes varied from 24,624.1 thousand tons in 2010 to 79,325.2 thousand tons in 2017. In all the analyzed periods it is found a positive trade balance. Grape exports, according to the data, in the period 2010-2017 varied from 26,737.6 thousand tons (2010) to 80,238.7 thousand tons (2017), and in financial terms - from 12,989.7 thousand USD (2010) to 38,625.9 thousand USD (2017). The import of grapes ranked in the range of 2,113.5 thousand tons (2010) to 913.4 thousand tons (2017), and in financial terms - from 2,715.4 thousand USD (2010) to 1,605.7 thousand USD (2017).

In recent years, there has been an important increase in the consumption of fresh grapes, due to the general trend towards a healthy diet, increasingly rich in plant resources [16]. Millions of people consume fresh grapes, because they are universal in taste and healing properties, they contain the most necessary and easily assimilable sugars (glucose and fructose) [1; 14; 8].

Grapes, having curative-therapeutic qualities, through their ability to eliminate heavy metals from the human body, are welcome to exist in the human diet all year round. Producers face the need to extend the consumption period of fresh grapes, which can be ensured in two ways: *by cultivating varieties with a semi-late or late ripening period,* and *by adjusting agrotechnical procedures and technologies for growing and storing table grapes* [10]. Varieties of table grapes are distinguished by different characteristics (flavor, color, grain shape/size and ripening period), which allows the organization of plantations in conveyor belts [14].

Since the ripening of table grape varieties is carried out in stages, we can provide consumers with fresh production for a period of 3-4 months [8; 9]. At the same time, the delivery of table grape production can be done over a longer period of time and involves a more balanced spread of income. Depending on the market demand for table grapes, grape cultivation differs and is profitable, and it largely depends on several factors, such as: maturation period; the quality of the grapes; the production cost.

The development of table grape varieties at the level of current requirements and in the future, cannot be conceived without knowing their agrobiological and productive potential and how they react to different climatic factors and agrotechnical procedures (driving system, cutting length, load of stumps, green operations, etc.).Therefore, studying the existing autochthonous varieties and the new ones is a current problem [14; 16].

Compared to the cultivation of varieties for wine, the cultivation of table varieties is given much lower attention as mentioned by Nicolaescu, Gh. et al. [14]. This state is observed in several countries of the world, including the Republic of Moldova. This phenomenon is explained by the economic interest not yet realized by the potential producers, as well as by the difficulties dictated by the specifics of the technology of cultivating table varieties – a lot of manual work in the care, harvesting, sorting, transporting, storing and marketing of grapes. Table varieties are more sensitive to adverse factors (winter frosts) and require a special technological infrastructure compared to wine grapes. For these reasons, the culture of table varieties has not yet developed progressively [4].

Găină (2002) [5] mentioned that the horticultural branch, including the vitivinicultural complex, can ensure the growing demands of the domestic and foreign market with high quality, competitive and

economically effective production. Starting from 2006, in the Republic of Moldova, greater attention is paid to the development of viticulture for table grapes. The *GD on the restoration and development of viticulture and winemaking in the years 2002-2020* was developed [7].

In the general assessment of the efficiency of the economic activity, the "*profitability*" category is very useful. Profitability represents an essential aspect of economic efficiency and constitutes a fundamental element of determining the yield value of an agricultural unit [21]. An agricultural enterprise is profitable when it covers its production costs on account of its own income and obtains a certain profit. Profitability is one of the essential aspects of the economic efficiency of agricultural units; therefore, a condition essential of production is that they must be not only useful but also profitable [15].

In the following, a practical example of a technological data sheet for the cultivation of table grapes in full fruit is proposed from the 4th year, the harvest per hectare is 12 tons. Grape production is sold directly from the field at an average price of 9 lei/kg [8].

Table 1.Operational expenses and forecast revenues in grapes ;production (harvest 12t/ha, area 10 ha), lei

| | **Planting/ I year of vegetation** | **Total costs/year II lei** | **Total costs/year III lei** | **Total costs/year IV lei** |
|---|---|---|---|---|
| a. Investments | 3,386,900.00 | 215,000 | | |
| b. Material expenses | 908,975 | 438,950.5 | 24284.1 | 67679.5 |
| c. Cost of mechanized technological operations | 28,108 | 37,428.5 | 36386 | 52144.2 |
| d. Cost of manual techno-logical operations | 10,887.5 | 5,095.94 | 8485.6 | 8536.7 |
| e. Constant costs: taxes and duties | 7,954.02 | 7954.02 | 7954.02 | 7954.02 |
| f. Direct expenses | ***4,342,824.52*** | ***704,428.96*** | ***77,109.72*** | ***136,314.42*** |
| g. Indirect expenses | ***868,564.90*** | ***140,885.79*** | ***15,421.94*** | ***27,262.88*** |
| h. Total operating expenses | **5,211,389.42** | **845,314.75** | **92,531.66** | **163,577.30** |
| TOTAL GROSS INCOME | | | | 1,075,635.00 |
| GROSS PROFIT | | | | **912,057.7** |
| Profitability rate (%) | | | | **57.56** |

Source: Calculations made by the author.

Both the market prices of the planting material used and their number were analyzed and taken into account, the prices of phytosanitary products that were taken from the price lists of phytosanitary product traders, the technological data sheets on grape cultivation were consulted. The rest of the information regarding the establishment of costs (normative expenses of agricultural production) was taken from the periodical edition "Cost rates and norms of net income in agriculture" [3]. Resulting from the calculations presented in the table in year IV (full fruit entry), the amount of sales revenue amounts to approximately 1,075,635 lei and the total cost of vineyard maintenance expenses amounts to 163,577.30 lei. Following the calculations, the annual profit obtained is 912,057.7 lei [8; 9]. And in order to highlight the efficiency of the production of table grapes from an economic point of view, the following indicators were calculated:

(i) *the recovery period* is a static indicator for evaluating economic efficiency, as well as a risk indicator. It is calculated by dividing the total investment to the average annual "net"

flow of money ensured by the exploitation of the respective investment object, lei/year.

$$Tp.p. = \frac{\text{IC}}{\text{Pm.a.}} \quad (years). \text{.....(1),}$$

where:
IC – the initial cost of the investment (Initial Cost – IC), lei;
P.m.a. - the average annual "net" flow of money, ensured by the exploitation of the respective investment object, lei/year.

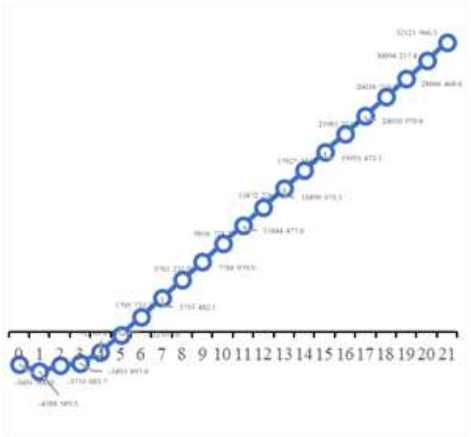


Fig. 3 Investment recovery period presented in years, lei
Source: Elaborated by the author.

Thus, we note that the cost of the investment will be reimbursed and even exceeded by the amount of 1723592 lei in the 6th year of activity.
(ii) *The coefficient of investment effectiveness* which is calculated according to the formula:

$$ARR = \frac{AAP}{\text{IC}} \times 100\% \text{.....(2),}$$

where,
APP- average annual profit
IC – investments

$$\text{APP} = \frac{Total\ profit}{the\ total\ duration\ of\ the\ investments} = 17{,}861{,}931$$

Thus, it follows that

$$\text{ARR} = \frac{17{,}861{,}931}{3{,}601{,}900} * 100\% = 49.6\%$$

(iii) *Profitability* – from the point of view of economic content, it reflects the effectiveness of the sales activity of production enterprises. The rate of return on production is calculated as the ratio of the gross profit from the sale of production to the cost of agricultural production sold.

$$R = \frac{Pb}{Vv} * 100\% \text{.....3,}$$

where,
Pb- gross profit;
Vv- sales revenue

R=118%

is positive, a fact that demonstrates the profitable capacity of the project, which is obviously feasible.

## CONCLUSIONS

For the Republic of Moldova, the vitivinicultural sector is a strategic one, and grapes and wine are the calling card of our country.
In the analyzed period 2010-2018, we observe an average annual increase in the productivity of the vineyard per fruit by 6.2; table grape harvest - by 8.4%; export of table grapes - by 7.1%. For entrepreneurs to register performance in the vitivinicultural sector, it is necessary to establish viticultural plantations with competitive varieties. In order to produce quality grapes and increase the harvest, it is necessary to use modern technologies. And in order to sell grapes in the cold period and obtain an advantageous price, it is necessary to invest in the processing infrastructure and post-harvest operations by creating cold storages. From the point of view of making the expenses, the greatest pressure is recorded in the period (year I-II), only for the planting of vines on an area of 10 ha, the expenses represent 955,924.52 lei. The investment recovery period in our case was 6 years, the cost of the investment will be reimbursed and even exceeded by the amount of 1,723,592.0 lei. The coefficient of investment effectiveness was 49.6%. According to the data obtained from the calculation of the *profitability index (R),* the production and

realization of table grapes constituted almost 118%.

## ACKNOWLEDGEMENTS

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# SUPPORTING THE RURAL ENVIRONMENT IN ROMANIA THROUGH FINANCING FROM EUROPEAN FUNDS IN THE TRANSITION PERIOD 2021-2022

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***Abstract***

*The continuation of financial assistance for Romanian farmers and entrepreneurs from rural areas during the years 2021–2022, which will serve as the CAP's transitional years, has been regulated at the EU level. From the standpoint of financing the rural area in Romania, the current article intends to highlight the contribution of the National Rural Development Program's initiatives throughout this period. The measures that could be accessed during the transition period are synthetically presented. The support granted to the Romanian agricultural and non-agricultural sector will increase the degree of modernization of farms, their expansion and development, will support the installation of young farmers who start an agricultural activity for the first time as holding managers and the development of farms led by young people who were installed during previously, diversifying the valorization of agricultural production as well as supporting the implementation of actions within local development strategies. The National Programme of Rural Development (NRDP) budget for the transition period 2021-2022 was approximately 3.26 billion euro, and the funds must be spent by December 31, 2025 at the latest.*

***Key words*****:** *: rural development; grant funding, Common Agricultural Policy, transition period 2021-2022*

## INTRODUCTION

For three key reasons, the Common Agricultural Policy was and remains very important for the future of rural areas in Europe. First off, as rural development today mobilizes new sources of income, that it is a response to the "pressure" applied on European agriculture [15].

In recent years, interest in strategies and policies to deal with rural regions long affected by population decline has intensified in many European countries and regions. Specific documents addressing this specific policy orientation have been developed at different scales, reflecting a wide range of concerns and proposing a variety of responses that have been integrated through different approaches to policy coherence [2].

The grounds for restablishing the eroded rural economy are provided by rural development policy. Second, the establishment of new connections between agriculture and society stands out as one of the main features of rural development. [15]

Rural development involves the creation of new products/services, new markets and new ways of reducing costs, which generally coincide with society's needs and expectations.

Thirdly, rural development also refers to the redefinition and reorganization of rural resources. In other words, rural development policy has the role of mobilizing new resources ensuring ecological stability and developing new, strong economic mechanisms by merging them with current ones. Additionally, new resource combinations allow for the creation of multipurpose businesses and new networks that connect urban and rural areas [15].

In Romania, these considerations transposed into good practice actions were and are being transposed both through the execution of the national rural development programs and the national rural development policies, respectively NRDP 2007-2013 and NRDP

2014-2020. The rural development programs for the period 2014-2020 start from these aspects and extend also for the transition period 2021-2022, to the CAP 2023-2027, the provisions related to ensuring the socio-economic consolidation of our country [9, 10, 11, 12].

In this sense, the two major events with socio-economic impact at European level, namely the difficulties caused by Brexit and the Covid-19 pandemic, determined that the programming period of the Common Agricultural Policy 2021-2027 be divided into the transition period (2021 -2022) and the future CAP 2023-2027.

Thus, for Romania, in terms of EAFRD allocations, if we refer to the basic rule for the transition period, this was called: "old rules, new money", that is, the use of the current implementation regulations, (Basic Regulation (EU ) no. 1305/2013) - the 2014-2020 NRDP structure, for which the funds were initially allocated from the new multiannual financial framework (MFF), respectively the allocations planned for the years 2021 and 2022.

Following the negotiations at the EU level, these values were slightly increased, so that for the year 2021 Romania received 1,181 billion euro through the European Agricultural Fund for Rural Development - EAFRD (compared to the initial proposal of 965 million euro), and for the year 2022 the amount increased very slightly, reaching only 967 million euro, compared to 965 [3].

The Transitional Regulation proposal also makes some specific mentions, such as those related to climate and environmental measures, by which Member States were requested to start adapting to the new ambitions of the future CAP, allocating a minimum of 30 % of the budget for these types of measures.

Also, the allocation for the technical assistance of the member states was 4%, 5% for LEADER and local development and other mentions regarding the deadlines for multi-annual commitments, young farmers, etc.

To support the recovery following the impact caused by COVID-19, the European Union established a European Recovery Instrument (EURI) and allocated PNDR additional financial resources MFF, which were implemented taking into account as a part of the overall amount of support from the Union for Rural Development under Regulation (EU) No. 1305/2013.

The member states had the opportunity to decide the priorities of the two types of interventions, as a result of the elaboration of the needs analysis and the SWOT analysis, but also of the new effects caused by the prolonged context of the Covid-19 pandemic on agriculture and the rural environment.

As such, the EAFRD budget for Romania provided for the 2 years of transition is divided according to the data presented in Figure 1.

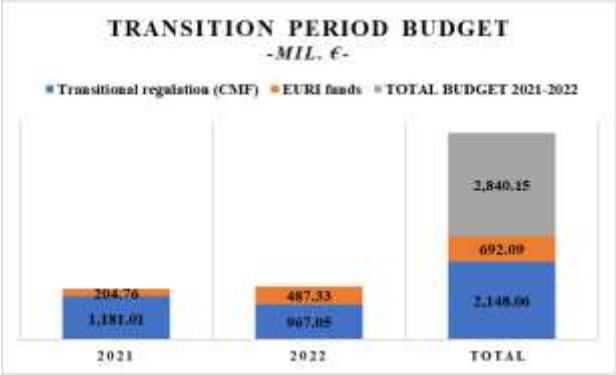


Fig. 1. Budget of the transition period, 2021-2022 (Euro million)
Source: Authors' own conception.

In this context, the purpose of the paper is to analyze the financial support from the EU funds for rural development in the period of transition 2021-2022.

## MATERIALS AND METHODS

To substantiate the methodology of this case study, the classic tools of observation and examination were used. Procedures based on factual analysis were used, a documentation at the level of the specialized literature existing in this field.

The methodology of the work has as direct tools the collection of information from the specialized literature and from the existing practice at the level of the relevant public institutions in our country, respectively Ministry of Agriculture and Rural

Development (M.A.R.D.) [11, 12], Rural Investment Financial Agency, Payment Intervention Agriculture Agency, etc [13, 14].
On the other hand, the new provisions and orientation documents in this field, offered and consolidated by the new CAP post 2020, the new NSP 2023-2027, the European Rural Development Network (ENRD 2021), the European Commission, The 2030 Strategy, the Transitional Regulation, the new Regulations on the NSP 2023-2027, etc.

## RESULTS AND DISCUSSIONS

In terms of financial and intervention tools, the Common Agricultural Policy remains to be the most significant EU policy that affects the EU rural sector. Farmers' income is significantly influenced by the CAP (direct support, market policy, and rural development policy) [5].
The rural population and economy are both significantly impacted by this. Through the EAFRD, the rural development strategy has provided and continues to provide a wide range of instruments to support the development of rural areas since Romania's entrance to the European Union in 2007.
Based on integrated strategic approaches that reflect EU priorities, as well as the needs of a territory, the 2007-2013 and 2014-2020 rural development programs supported a mix of measures to contribute to the achievement of the established development objectives. In the new NSP 2023-2027 [11], it is mainly proposed to support interventions aimed at achieving the environmental objectives, as established in the European Ecological Pact - "Green Deal", interventions that will fulfil the objectives of the "Farm to Fork" strategy and which will contribute implicit in the implementation of the new Smart Village Concept. These measures target the development of rural business, which also include modernization of farm, small businesses and projects of connectivity, rural area renewal, knowledge expansion, exchange of information and bottom-up efforts.
As part of the Rural Development Policy, LEADER is a bottom-up approach to local development, that serves as an instrument for social innovation and enhancing local governance, supporting rural residents to take decisions on their community's growth by creating and putting into practice local development strategies (LDS) and projects. [6].
Rusu A. (2021) [18] said that a crucial part in this context belongs to the LAGs who at the local level can contribute directly to the mobilization of local residents, entrepreneurs, civil society and local public authorities, to identify innovative solutions that meet the needs local. The exchange of views on challenges and opportunities, facilitated by the LAG, leads to the development of rural communities from an economic and social point of view and creates the conditions for bringing the local community to the level of a Smart Village [8].
This approach can create the conditions for greater investments from rural development programs (NRDP), cohesion funds or from the national public and private level.
This approach can create the conditions for greater investments from rural development programs (NRDP), cohesion funds or from the national public and private level.
The distribution of financial resources for funding agriculture and rural development programs represents one of the primary elements of the Common Agricultural Policy (Gosa et al. 2013) [7].
One of the main forces pushing Romania's rural areas toward a more sustainable future was the NRDP 2014-2020. (Dinu et al. 2020) [4, 10].
Ciobanu A. [1] considers that all of the Common Agricultural Policy's strategic plans must be ready to enter into force as soon as the transition period ends, in order to provide the stability and certainty so necessary for the agricultural sector.
Romania must take steps to increase the capacity of rural areas to absorb community funds, in order to develop farms of European size (Podaru & Rahoveanu, 2021) [16].
To ensure financial support for EU farmers during the transition period 2021-2022 and to maintain vitality in rural areas, as well as to contribute to environmental sustainability, EU Regulation 2020/2020 laying down certain

transitional provisions on support from EAFRD and EAGF in 2021 and 2022, establishes the legal basis for the for the continuous use of the current CAP framework (2014-2020) until the date of application of the new legal framework covering the period starting on 1 January 2023 (Ciobanu A., 2021) [1].

The allocation from the European Agricultural Fund for Rural Development (EAFRD), assigned for the implementation of the NRDP in the period 2014-2020 in the amount of 8.13 billion euro, was supplemented based on Regulation (EU) no. 2220/2020 [17] which stipulates the extension of the applicability of the existing legal framework in the years 2021-2022, with 2.15 billion euro of resources from the Multiannual Financial Framework (MFF) 2021-2027 and with 0.69 billion euro of funds from the Recovery Instrument of the European Union (EURI) as a result of the crisis caused by the COVID-19 pandemic. Added to this is the national contribution, from the state budget, in the amount of 1.73 billion euro.

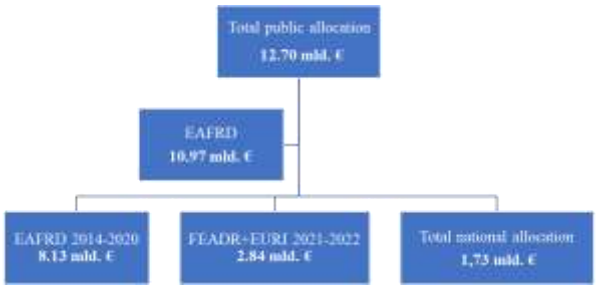


Fig. 2. Grant EAFRD
Source: The Agency for Financing Rural Investments [13].

The cumulative stage of implementation, from the launch of the Program in 2015 until now, is transposed by expressing the total number of funding requests submitted for investment measures, which is 104,136, with a public value of 12.23 billion euro, of which 68,518 requests with a public value of 6.80 billion euro were selected for financing. Also, the number of financing contracts/decisions concluded for investment measures is 80,310 with a public value of 6.12 billion euro. For the NRDP measures (from FEADR and the State Budget), public payments of 8.82 billion Euros were made, of which 7.62 billion Euros represent funding from the European budget and 1.20 billion Euros represent national contribution. Thus, the degree of absorption of the 2014-2020 EAFRD, including the transition period, is currently 69.49%.

Regarding the investment measures launched in the transition period 2021-2022 [12], we analyzed the information on the allocations, as well as the number and value of the projects submitted at the R.I.F.A. level. A number of 35,235 investment projects were submitted, worth 2,480,896,633.03 Euro, being selected for financing 22,750 projects, worth 1,336,890,189.73 million €, over 28,000 farmers, public authorities, entrepreneurs and processors requesting European funds for agriculture and rural development.

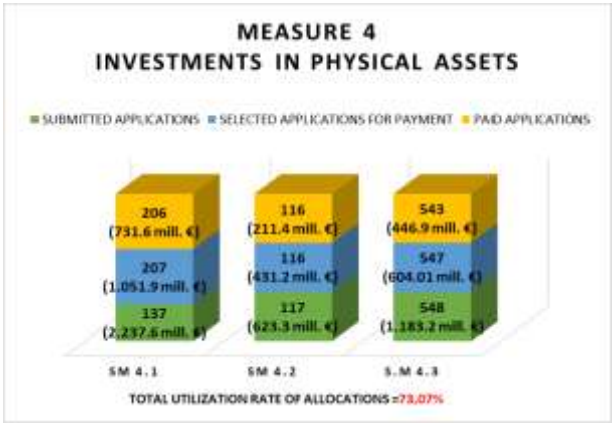


Fig. 3. Measure 4 ”Investment in physical assets”
Source: The Agency for Financing Rural Investments [13].

The total degree of use of allocations for Measure 4 is 73.07%, the best access being recorded by submeasure 4.3 "Support for investments in infrastructure related to development, modernization or adaptation of agriculture and forestry", through this submeasure offering is an important support for the establishment, expansion and modernization of the agricultural access infrastructure to farms, but also for the modernization of the existing irrigation infrastructure. For Submeasure 4.1 "Investments in agricultural holdings" significant funds (€2,237.6 million) were allocated, in order to support the investments required to improve agricultural holdings' competitiveness.

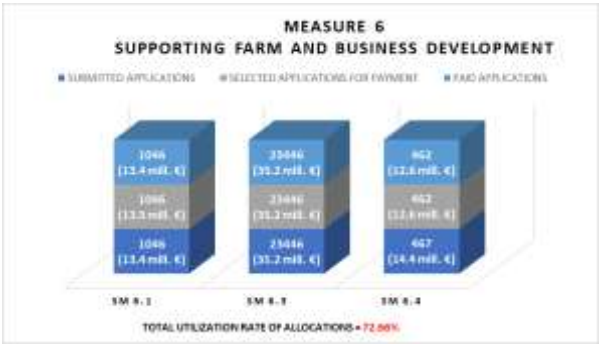


Fig. 4. Measure 6 "Supporting farm and business development"
Source: The Agency for Financing Rural Investments [13].

Due to the large number of projects submitted under sub-measure 6.3, "Support for the development of small farms," there is an increasing need for financing investments for the development of small farms, including investments to modernize the farm and enhance the quality of fixed assets. These investments should also be made to supply small farms with high-performance machinery and equipment respecting to the current agricultural structure.

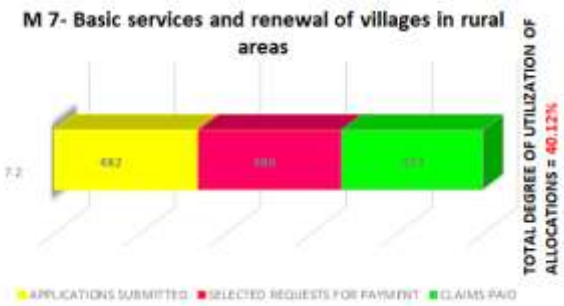


Fig. 5. Measure 7 "Basic services and village renewal in rural areas"
Source: The Agency for Financing Rural Investments [13].

For Submeasure 6.4 "Investments in the creation and development of non-agricultural activities" important sums were allocated to stimulate the business environment in the countryside, the non-agricultural sector attracting 467 entrepreneurs who submitted funding requests to R.I.F.A. in the amount of approximately €14.4 million. The total percentage of allocations that have been used of Measure 7 is 40.12%. In Romania, rural depopulation started to be a problem, its negative effects being stronger and stronger. To stop this social development and make sure that rural regions continue to be attractive to future generations, concrete measures are required. The long-term improvement of the quality of life in rural regions is intended to be facilitated by development of services for the general interest, the provision of infrastructure, the promotion of environmentally friendly mobility solutions, the building of low-level road networks, as well as the development of broadband infrastructure.

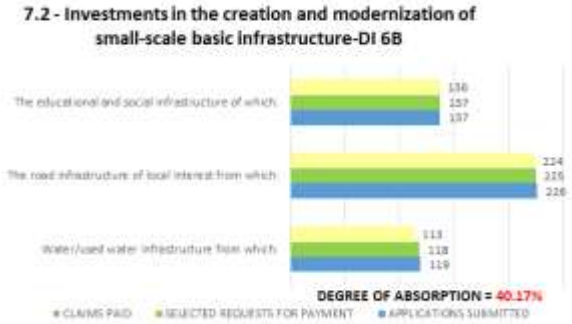


Fig. 6. Sub-measure 7.2 "Investments in the creation, improvement or expansion of all types of small scale infrastructure"
Source: The Agency for Financing Rural Investments [13].

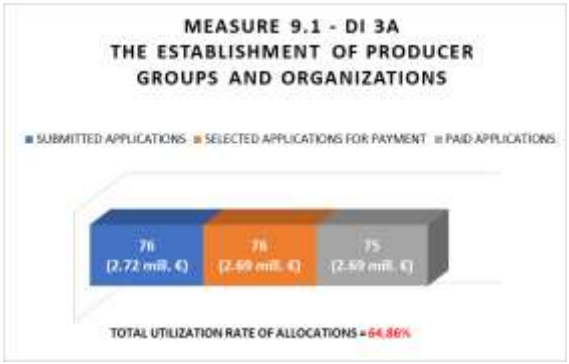


Fig. 7. Measure 9.1 "The establishment of producer groups and organizations"
Source: The Agency for Financing Rural Investments [13].

The creation of road infrastructure of local interest will contribute to diminishing social and economic decline trends and improving the standard of living in rural areas. 226 claims have been submitted, of which 224 have been paid to date. For a better joint valorization of the members' agricultural products, important requests were also

allocated for the establishment of producer groups, 76 requests in the amount of €2.69 million being submitted and selected for payment. Also, in order to ensure the continuity of the implementation process of the Local Development Strategies (LDS), additional funds were granted to the Local Action Groups (LAG) during the transition period to the next programming period, in the amount of 123 million Euros, of which 9.5 million EURO EAFRD and 2.8 million EURO EURI. Following the distribution of these funds, the budget of each LDS was supplemented on average by over 500,000 EURO. At the same time, 5 million EURO are reserved for the financing of the preparatory support for the development of future strategies that will be implemented in the period 2023-2027.

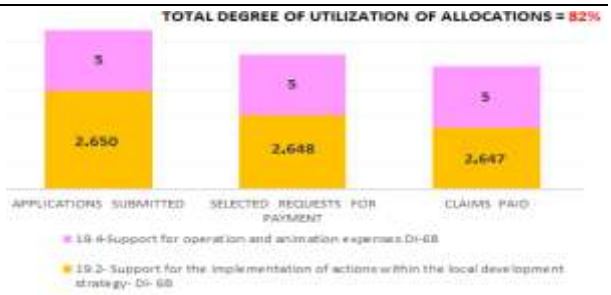


Fig. 8. Measure 19 LEADER
Source: The Agency for Financing Rural Investments [13].

Ensuring operating costs and those achieved with the animation activities of Local Action Groups, as well as stimulating innovation, creating and keeping jobs in LEADER areas, improving the quality of life and the attractiveness of the local area are just some of the objectives that will be achieved by implementing the projects accessed through the LEADER axis.

Table 1. P.I.A.A. area compensatory payment measures (Euro Million)

| Measure | NRDP allocation of which | | | | Payments made, of which: | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | NRDP 2014-2020 | Transition MFF 2021-2022 | EURO | NRDP 2014-2020 | Transition MFF 2021-2022 | EURO | Total payments |
| Measure 8,,Investments in the development of areas and improving the viability of forests" | 21.18 | 21.18 | 0.00 | 0.00 | 0.00 | 6.27 | | 0.00 |
| Measure 10, "Agro-environment and climate" | 1,124.16 | 835.40 | 142 | 146.76 | 125.40 | 732.79 | 0.00 | 0.00 |
| Measure11,,Ecological agriculture" | 479.35 | 247.07 | 129.63 | 102.65 | 12.72 | 240.07 | 91.91 | 0.00 |
| Measure 13 "Payments for areas facing natural constraints or other specific constraints | 2,182.84 | 1,522.72 | 660.12 | 0.00 | 0.46 | 1,527.97 | 269.82 | 0.00 |
| Measure 14, "Animal welfare" | 1,066.09 | 792.49 | 273.60 | 0.00 | 477.73 | 311.92 | 121.75 | 0.00 |
| Measure 15 "Silvo-environmental services, climate services and forest conservation" | 115.15 | 115.15 | 0.00 | 0.00 | 0.00 | 51.51 | 0.00 | 0.00 |
| Measure 21,,Specific measure of grant of exceptional temporary support within the EAFRD in response to the COVID epidemic" | 182.50 | 182.50 | 0.00 | 0.00 | 0.00 | 180.28 | 0.00 | 0.00 |

Source: R.I.F.A., Authors conceptualization.

**Direct payments in Romania during the transition period 2021-2022**

In the transition period 2021-2022, the EAGF continue to supports farmers through a variety of payment plans, such as a basic payment plan, a payment for young farmers, and payments for sustainable agricultural practices (also known as "green direct payments"). The EU's regulations on food safety, environmental protection, and animal welfare must be followed in order for any compensation to be made.

Through the EAGF, farmers generally receive income support based on the size of their farm in hectares.

All EU countries must offer a basic payment, a payment for sustainable farming methods ("greening") and a payment for young farmers.

As it is mandatory for EU countries to provide these payments, they are often referred to as mandatory payments.

In Table 1, it is presented the situation of compensatory payments per area for the transition period 2021-2022, with annual submission, the implementation of which was delegated to P.I.A.A.

## CONCLUSIONS

Regulation (EU) no. 2220/2020 (Regulation for the transition period of the Common Agricultural Policy) provides for extending the applicability of the current legal framework for rural development, in 2021-2022, and supporting the NRDP budget with funds related to the years 2021 and 2022 in order to guarantee the continuity of the support provided to farmers and other beneficiaries under the CAP in 2021 and 2022.

These financial resources come from the new Multiannual Financial Framework (MFF 2021-2027) and, besides them, the Member States benefit in the current rural development programs (RDP) 2014·2020 from additional funds from EURI funds, the Next Generation EU instrument, as a consequence of the crisis generated by COVID-19.

An important allocation is intended for environmental and climate measures, keeping the percentage of expenses intended for these measures at the same level as in the NRDP in force, as well as financing the application campaigns until 2023, inclusive.

The budgets of the current NRDP were supplemented for most of the measures aimed at private investments, but other relatively new measures within the NRDP intended for cooperation or insurance premiums were also considered.

The availability of new funds for sM 6.1 (young farmers), sM 6.2 (non-agricultural start-ups), sM 6.4 (non-agricultural investments), Measure 14 (animal welfare), but also the correction of funding imbalances regarding different sectors agricultural or the stimulation of investments in certain deficit areas from the point of view of the trade balance. At the same time, the additional funds intended for LEADER ensure the maintenance of reasonable support for local development, which provides an easier transition to the next programming period.

The transitional period ought to give EU nations enough time to draft and get ready for putting their own CAP strategic plans into action. According to the European Green Deal goals, the transitional regulation will direct the EURI's additional resources toward funding a sustainable, resilient and digital economic recovery.

## ACKNOWLEDGEMENTS

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# A LINEAR SIMULATION MODEL FOR OPTIMIZING CROP STRUCTURE IN ORDER TO MAXIMIZE INCOME IN A VEGETAL AGRICULTURAL FARM

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***Abstract***

*Agriculture, as the basic branch of the national economy, is placed among the priority areas of the application of informatics. The goal of the agricultural digitalization strategy is to incorporate computer technologies at the workplace of engineers, technicians, economists and farm managers. Emphasis is placed on the development of software products for the design and implementation of high-performance remote data processing systems and database management systems, along with a sustained concern for professional training of users and providing technical assistance to production units. In this context the paper aimed to set up a linear simulation model for optimizing crop structure in order to maximize income in a vegetal farm using linear programming and simplex method. The model included: the 8 unknown variables for the cultivated area with 8 crops: wheat, rye, barley, peas, rape, soybean, maize and sunflower, 14 restrictions regarding Diesel fuel, fertilizers, herbicides, total surface, expenditures, income, and area per each crop, and objective - function f(Max) Income. The data processing for the simulation model was assisted by Solver from MS Excel application. The results offered solutions for the basic primal and dual problems. For a surface of 760 ha entirely cultivated, the optimal area by crop was the following one: 120 ha wheat, 25 ha rye, 120 ha barley, 50 ha peas, 90 ha rape, 125 ha soybean, 170 ha maize, 60 ha sunflower. The maximum income obtained was Lei 2,210,750, while the consumed expenditures accounted for Lei 1,349,150 and profit for Lei 861,600. Average profit rate was Lei 0.64 per 1 Leu spent. The model also assured savings of Diesel and NPK. As a final conclusion, this simulation model proved that farmers have at their disposal an important IT tool which could help them to use linear programming and simplex method to find optimal solutions for their practical technical and economic problems and assure a high efficient agrobusiness.*

***Key words*****:** *crop structure and income optimization, mathematical model, linear programming, simplex method*

## INTRODUCTION

The modelling and simulation of economic processes is a discipline at the border of mathematics and computational techniques and aims to substantiate the managerial decisions in conditions of efficiency for the producer, with the help of economic-mathematical models.

The modelling of a decision-making process leads to specifying its elements: formulating the problem, specifying the objectives proposed by the decision-maker (minimizing/maximizing some technical-economic indicators), specifying the multitude of possible variants/alternatives that characterize a decision-making situation, specifying the multitude of anticipated consequences for each variant, specifying independent decision-making factors of a conjunctural type. From the multitude of calculated possible variants, the decision-maker is going to retain only one, namely the most convenient one. The solution that the decision-maker will choose depends on the data he is analyzing [22].

Optimization of the agricultural production is an attribute of farm manager who must look for new solutions for increasing yields, productions, incomes and profit or for decreasing production expenditures.

The mathematical modelling of the biological, technical and economic processes is deeply sustained by the increase of performance in computer science. Nowadays, computers are capable to simulate the structure and evolution of the mathematical models set up by the farm manager and the results of the simulation to be compared to the data of the modelling process. The main advantages of modelling

and simulation are the opportunities to analyze and synthesize the modelled processes and their dynamics.

In agriculture, production processes could be analyzed and optimized both at the macro-economic level and at micro economic level, more exactly at the farm or agricultural holding level.

One of the most utilized tools in the manager's hand for optimizing agricultural processes is linear programming (LP).

The foundation of this mathematical method is recognized to belong to Leonid Kantorovich, a Russian mathematician who developed "linear programming problems" in 1939, then to George Bernard Dantzig, an American mathematician who is properly acclaimed as "the father of linear programming" and who published "simplex algorithm" in 1947 and further John von Neuman, a Hungarian-American mathematician who developed "the theory of the duality" also in 1947 [21].

Linear programming was created to be used in the "maximization or minimization of a linear function in which different variables are subject of restrictions" [8, 9, 10, 17].

The objective function of the linear programming is a linear expression which depends on the optimization variables, $x_i$, required to satisfy certain linear restrictions of equality and non-equality [11, 25, 27].

Linear programming is successfully applied in agriculture both in vegetal and animal production for various purposes.

For example, for establishing the optimal structure of agricultural crops, a mathematical model could be used, that considers the income and expenditure of crops per hectare. In this way, the area of each crop is determined and the maximum income or gross margin or profit level could be derived combining the areas of each crop. Therefore, applying the econometric model of linear programming, it is possible to optimize economic indicators such as income, gross margin and profit based on the optimization of crop and production structure [19, 21, 28, 29].

Also, linear programming is used for the optimization of the cultivated area and crop structure in order to identify the feasible optimal crop combination and rotation which could led to production maximization [5, 15, 26].

In animal farms, linear programming is an important tool for optimizing feed rations in order to minimize ration cost, for optimizing forage balance in relationship with the livestock structure, for optimizing livestock structure in order to increase production [2, 4, 15, 23, 24].

Also, linear programming could be used for optimizing profit in pasture grazing with beef cattle and sheep [1].

Moreover, transport expenditures could be optimized in relation to the need to buy farm inputs from various suppliers etc. [12].

Also, linear programming is often used in agriculture for economizing water, labor, energy, fertilizer and other resources [6, 7].

In order to enhance the importance of Linear Programming in agriculture, Alotaibi and Nadeem (2020) developed LP applications concerning: feed mix, crop pattern and rotation plan, irrigation water, and product transformation [3].

In this context, the purpose of this research study is to set up a mathematical linear model for obtaining a maximum income under the conditions of limited expenditures, which involves linear programming and simplex method for carrying out the solutions regarding the optimized crop structure. For attaining this goal, the IT analysis was made using the Solver from MS Excel application [13].

## MATERIALS AND METHODS

The optimization model consists of the following components:

(a) The unknown variables of the model symbolized as: $x_1,\ldots\ldots\ldots\ldots,x_n$ which are positive real numbers which has to be determined or positive whole numbers or even binary values.

(b) The restrictions of the mathematical model which are m equations which contain the unknowns $x_1,\ldots\ldots\ldots\ldots,x_n$. Each restriction regards the limits of the resource to whom it is referred.

(c)The objective-function of the model which could be counted as "p" and contains the

unknowns $x_1,.....,x_n$ which are going to be optimized (maximized or minimized) [15].

The linear model simulation proposed in this study will consider the history of an agricultural farm for test data, which will represent the support for a manager of an agricultural holding [16].

It is considered that the farm has an agricultural cultivated area of 760 ha which must be cultivated with the following crops: wheat, rye, barley, peas, rapeseed, soybean, corn and sunflower.

The purpose of the research is to obtain a variant of the distribution of the surface of each crop under the conditions of limited expenses in the amount of Lei 1,349,150.

**The mathematical model developed in this research is represented by:**

***(a) The unknown variables of the model which are going to be calculated***

They are 8 unknown variables represented by $x_1$, $x_2$, $x_3$, $x_4$, $x_5$, $x_6$, $x_7$, $x_8$, the cultivated areas which are going to be determined: wheat, rye, barley, peas, rape, soybean, maize and sunflower [14].

***(b)The restrictions of the model***

The 14 restrictions proposed in the model regard: Diesel fuel, Herbicides, Chemical fertilizers, The total area, The minimum areas required for each culture, Expenditures and Income, as follows:

-Diesel fuel <= 158,000
-Herbicides <= 55,000
-Fertilizers <= 162,000
-Limited expenditures <= 1,349,150
- Total cultivated surface = 760 ha
- Min area for wheat $x_1$ >=120 ha
-Min area for rye $x_2$>=25 ha
-Min area for barley $x_3$ >=35 ha
-Min area for peas $x_4$>=50 ha
-Min area for rape $x_5$>=90 ha
-Min area for soybean $x_6$>=70 ha
-Min area for maize $x_7$>=170 ha
-Min area for sunflower $x_8$>=60 ha
Total Income ≥ 1,842,000 Lei.

***(c)The objective function***

The objective-function aims to maximize income and has the form given below:

$$F(_{MAX}) \text{ Income} = C_1x_1 + C_1x_2 + C_3x_3 + C_4x_4 + C_5x_5 + C_6x_6 + C_7x_7 + C_8x_8 \quad .....(1)$$

where:

$C_1$, ....., $C_8$ are the coefficients of the objective-function represented by maximum income desired for each crop cultivated on unknown surfaces $x_1,.....,x_n$ which are going to be optimized.

The data were processed using SOLVER from MS Excel Application and the results and tables are correspondingly commented.

## RESULTS AND DISCUSSIONS

**The mathematical model developed in this research is represented by:**

***(a) The unknown variables of the model which are going to be calculated***

These are:

$x_1$- cultivated area with wheat
$x_2$- cultivated area with rye
$x_3$- cultivated area with barley
$x_4$- cultivated area with peas
$x_5$- cultivated area with rape
$x_6$- cultivated area with soybean
$x_7$- cultivated area with maize
$x_8$- cultivated area with sunflower

***(b)The restriction of the model***

There are 14 restrictions of the mathematical model, as following:

***Diesel fuel***

$$170x_1+130x_2+150x_3+160x_4+170x_5+165x_6+220x_7+190x_8 <= 158,000 \quad .....(2)$$

***Herbicides***

$$70x_1+65x_2+60x_3+65x_4+70x_5+65x_6+90x_7+80x_8<=55,000 \quad .....(3)$$

***Fertilizers***

$$200x_1+160x_2+140x_3+170x_4+190x_5+150x_6+200x_7+180x_8<=162,000 \quad .....(4)$$

***Expenditures limits***

$$1,850x_1+1,400x_2+1,260x_3+1,450x_4+1,980x_5+1,850x_6+2,100x_7+1,700x_8 <= 1,349,150 \quad .....(5)$$

***Total Income*** ≥ 1,842,000 Lei

***Total cultivated area***=

$$x_1+x_2+x_3+x_4+x_5+x_6+x_7+x_8 = 760 \quad ...(6)$$

***Minimum cultivated area by crop:***

$x_1$>=120 (MIN area for wheat)
$x_2$>=25 (MIN area for rye)
$x_3$>=35 (MIN area for barley)
$x_4$>=50 (MIN area for peas)
$x_5$>=90 (MIN area for rape)

$x_6$>=70 (MIN area for soybean)
$x_7$>=170 (MIN area for maize)
$x_8$>=60 (MIN area for sunflower)

Expenditures were calculated summing all the costs belonging to each technological stage starting from plowing to harvesting, transportation and storage.

Incomes were determined based on the obtained grain production multiplied by market price.

Profit is given by the difference between incomes and expenditures per crop and farm.

The limits and the coefficients corresponding to each restriction are presented in Table 1.

Table 1. The matrix of the limits and coefficients corresponding to each restriction of the linear optimization model with limited expenditure and maximum income

| Crops / Resources | Wheat | Rye | Barley | Peas | Rape | Soybean | Maize | Sunflower | Restrictions - limits |
|---|---|---|---|---|---|---|---|---|---|
| Diesel fuel (liters/ha) | 170 | 130 | 150 | 160 | 170 | 165 | 220 | 190 | 158,000 litres |
| Herbicides etc. (lei/ha) | 70 | 65 | 60 | 65 | 70 | 65 | 90 | 80 | 55,000 lei |
| Chemical fertilizers (kg/ha) | 200 | 160 | 140 | 170 | 190 | 150 | 200 | 180 | 162,000 kg |
| MIN area (ha) | 120 | 25 | 35 | 50 | 90 | 70 | 170 | 60 | Total area = 760 ha |
| Expenditures (lei/ha) | 1,850 | 1,400 | 1,260 | 1,450 | 1,980 | 1,850 | 2,100 | 1,700 | Total ≤ 1,349,150 lei |
| Income (lei/ha) | 3,200 | 2,350 | 1,940 | 2,420 | 3,270 | 3,200 | 3,190 | 2,960 | Total ≥ 1,842,000 lei |

Source: Author's own conception of the simulation data and thresholds.

***(c)The objective-function***

The objective-function aims to maximize income and has the form given below:

$$F(_{MAX})Income = 3{,}200x_1+2{,}350x_2+1{,}940x_3+2{,}420x_4+3{,}270x_5+3{,}200x_6+3{,}190x_7+2{,}960x_8 \quad .....(7)$$

After the presentation of the mathematical model, Table 2 presents the data prepared to be introduced into an Excel spreadsheet [18].

In Table 3 it is shown the data written in the Excel spreadsheet.

We start from the initial solution:

$$x_1 = x_2 = x_3 = x_4 = x_5 = x_6 = x_7 = x_8 = 0.$$

In A11 cell the formula for the objective function will be written: =SUMPRODUCT(A4:H4,A7:H7).

In the column TOTAL, the formula for each restriction corresponding to each line will be written: =SUMPRODUCT(A4:H4,A14:H14), the last one being: =SUMPRODUCT(A4:H4,A26:H26).

The mouse cursor is then positioned in the cell (the easiest) and then the Solver add-in is called, from the top Ribbon, Data group, Analyze subgroup. Enabling Solver in MS Excel can be done from File, Options, Add-ins, select Solver Add-in, click on Go, select Solver-Add-in to enable it and confirm with OK.

Next, in Figure 1, we complete the required information in accordance with the data presented in Table 3.

There are set the 3 reports: Answer, Sensitivity and Limits which provide details about the solutions of the primary and respectively dual problems, useful for interpretations and forecasts.

In Table 4 the obtained results are presented: the values of the variables, that are: the surfaces allotted by the model in this variant in the field A4:H4 and, respectively, the value of the objective-function, that is the maximum income in the cell A11.

Table 2. The data prepared to be introduced into the Excel spreadsheet for solving the problem using Simplex Method with the SOLVER add-in from MS Excel Application

| **Restrictions** | **Wheat** $X_1$(ha) | **Rye** $X_2$(ha) | **Barley** $X_3$(ha) | **Peas** $X_4$(ha) | **Rape** $X_5$(ha) | **Soybean** $X_6$ (ha) | **Maize** $X_7$ (ha) | **Sunflower** $X_8$ (ha) | **Sign** | **Limits** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.Diesel fuel (liters/ha) | 170 | 130 | 150 | 160 | 170 | 165 | 220 | 190 | ≤ | 158,000 liters |
| 2.Herbicides (Lei/ ha) | 70 | 65 | 60 | 65 | 70 | 65 | 90 | 80 | ≤ | 55,000 Lei |
| 3.Chemical fertilizers (Kg/ha) | 200 | 160 | 140 | 170 | 190 | 150 | 200 | 180 | ≤ | 162,000 kg |
| 4.Expenditures (C) (Lei/ha) | 1,850 | 1,400 | 1,260 | 1,450 | 1,980 | 1,850 | 2,100 | 1,700 | ≤ | 1,349,150 Lei |
| 5.Surface (ha) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | = | 760 ha |
| 6.MIN area wheat | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ≥ | 120 ha |
| 7.MIN area rye | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | ≥ | 25 ha |
| 8.MIN area barley | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | ≥ | 35 ha |
| 9.MIN area peas | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | ≥ | 50 ha |
| 10.MIN area rape | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | ≥ | 90 ha |
| 11.MIN area soybean | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | ≥ | 70 ha |
| 12.MIN area maize | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | ≥ | 170 ha |
| 13.MIN area sunflower | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | ≥ | 60 ha |
| **Income (V)(Lei/ha)** | 3,200 | 2,350 | 1,940 | 2,420 | 3,270 | 3,200 | 3,190 | 2,960 | **MAX** | |

Source: Own work based on [20].

Table 3. The data entered in the Excel spreadsheet

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | |
| 2 | SOLUTION | | | | | | | | | | | |
| 3 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | | | | |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| 5 | OBJECTIVE FUNCTION COEFFICIENTS | | | | | | | | | | | |
| 6 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | | | | |
| 7 | 3200 | 2350 | 1940 | 2420 | 3270 | 3200 | 3190 | 2960 | | | | |
| 8 | | | | | | | | | | | | |
| 9 | OBJECTIVE FUNCTION: | | | | | | | | | | | |
| 10 | FO | | | | | | | | | | | |
| 11 | 0 | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | MATRIX A | | | | | | | | SIGN | B (limits - for restrictions of the model) | TOTAL | Resources consumed |
| 14 | 170 | 130 | 150 | 160 | 170 | 165 | 220 | 190 | <= | 158000 | 0 | |
| 15 | 70 | 65 | 60 | 65 | 70 | 65 | 90 | 80 | <= | 55000 | 0 | ← |
| 16 | 200 | 160 | 140 | 170 | 190 | 150 | 200 | 180 | <= | 162000 | 0 | |
| 17 | 1850 | 1400 | 1260 | 1450 | 1980 | 1850 | 2100 | 1700 | <= | 1349150 | 0 | ← |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | = | 760 | 0 | ← |
| 19 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | >= | 120 | 0 | ← |
| 20 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | >= | 25 | 0 | ← |
| 21 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | >= | 35 | 0 | |
| 22 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | >= | 50 | 0 | ← |
| 23 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | >= | 90 | 0 | ← |
| 24 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | >= | 70 | 0 | |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | >= | 170 | 0 | ← |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | >= | 60 | 0 | ← |

Source: Own research work results.

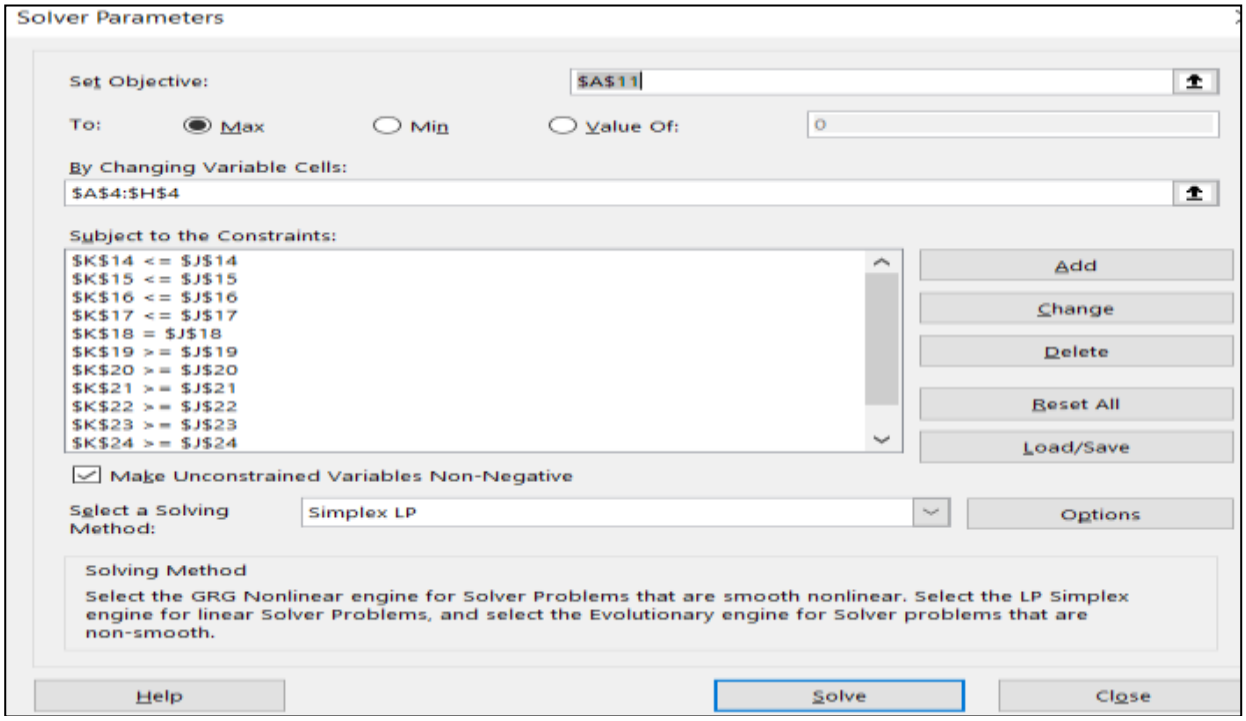


Fig. 1. Completing the information for Solver
Source: Own research work results.

Table 4. The obtained results for the surfaces allocated to each crop and the optimum income value

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | |
| 2 | SOLUTION | | | | | | | | | | | |
| 3 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | | | | |
| 4 | 120 | 25 | 120 | 50 | 90 | 125 | 170 | 60 | | | | |
| 5 | OBJECTIVE FUNCTION COEFFICIENTS | | | | | | | | | | | |
| 6 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | | | | |
| 7 | 3200 | 2350 | 1940 | 2420 | 3270 | 3200 | 3190 | 2960 | | | | |
| 8 | | | | | | | | | | | | |
| 9 | OBJECTIVE FUNCTION: | | | | | | | | | | | |
| 10 | FO | | | | | | | | | | | |
| 11 | 2210750 | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | MATRIX A | | | | | | | | SIGN | B (limits - for restrictions of the model) | TOTAL | Resources consumed |
| 14 | 170 | 130 | 150 | 160 | 170 | 165 | 220 | 190 | <= | 158000 | 134375 | |
| 15 | 70 | 65 | 60 | 65 | 70 | 65 | 90 | 80 | <= | 55000 | 55000 | ← |
| 16 | 200 | 160 | 140 | 170 | 190 | 150 | 200 | 180 | <= | 162000 | 133950 | |
| 17 | 1850 | 1400 | 1260 | 1450 | 1980 | 1850 | 2100 | 1700 | <= | 1349150 | 1349150 | ← |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | = | 760 | 760 | ← |
| 19 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | >= | 120 | 120 | ← |
| 20 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | >= | 25 | 25 | ← |
| 21 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | >= | 35 | 120 | |
| 22 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | >= | 50 | 50 | ← |
| 23 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | >= | 90 | 90 | ← |
| 24 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | >= | 70 | 125 | |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | >= | 170 | 170 | ← |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | >= | 60 | 60 | ← |

Source: Own research work results.

In Table 4 are presented the obtained results: the values of the variables, that are the surfaces allotted by the model in this variant in the field A4:H4 and, respectively, the value of the objective-function, that is the maximum income in the cell A11.

In Table 5 are presented the solutions offered by Solver for the primal and dual problems and for three economic indicators: Average profit rate, Marginal profit rate and profit elasticity rate [16].

Also, there are presented:

1.VPP - the values of the variables, that is of the surfaces which are going to be cultivated, proposed as a variant;

2.VPE - the differences between the consumed resources and their limits, named: „spreads*"*;

3.VDE - the additional income in Lei/ha for each crop;

4.VDP - Marginal incomes.

Maximum obtained income = **2,210,750** Lei;

Available and consumed Expenditures = **1,349,150** Lei;

Profit = Income - Expenditures = **861,600** Lei.

**Economic efficiency indicators:**

***Average profit rate***, RMP = Profit/ Expenditures = **0.64** Lei profit/1 leu spent

***Marginal profit rate,*** RDP = $y_4$ -1 **= -1 leu** increased profit / 1 leu increased expenditures

***Elasticity of the profit rate***, ERP= RDP/ RMP = **-1.56 %** profit growth /1 % expenditures growth

Changes could be done directly in the dialog box in Solver (see Figure 1) like: variable additions/deletions/restrictions, data changes.

Table 5. Solutions for the primal problem (column 1) and for the dual problem (column 2)

| **Solution for the basic optimal primal** | **Solution for the basic optimal dual** |
|---|---|
| 1)VPP (Cultivated areas)<br>$x_1$= 120 ha wheat<br>$x_2$= 25 ha rye<br>$x_3$= 120 ha barley<br>$x_4$= 50 ha peas<br>$x_5$= 90 ha rape<br>$x_6$= 125 ha soybean<br>$x_7$= 170 ha maize<br>$x_8$= 60 ha sunflower | 3)VDE (Additional income Lei/ha crop)<br>$ye_1$= 0 Lei additional income/ha wheat<br>$ye_2$= 0 Lei additional income/ha rye<br>→$ye_3$= 7.66 Lei additional income/ha barley<br>$ye_4$= 0 Lei additional income/ha peas<br>$ye_5$= 0 Lei additional income/ha rape<br>→$ye_6$= 595 lei additional income/ha soybean<br>$ye_7$= 0 Lei additional income/ha maize<br>$ye_8$= 0 Lei additional income/ha sunflower |
| 2)VPE -Differences between the consumed resources and their limits- "*spreads*"<br>$xe_1$= 23,625 liters non consumed Diesel fuel<br>→$xe_2$= 0 lei unspent on herbicides<br>$xe_3$= 28,050 Kg non consumed NPK<br>**→$xe_4$= 0 Lei unspent money**<br>→$xe_5$= 0 ha non cultivated land<br>→$xe_6$= 0 ha wheat surplus<br>→$xe_7$= 0 ha rye surplus<br>$xe_8$= 85 ha barley surplus<br>→$xe_9$= 0 ha beans surplus<br>→$xe_{10}$= 0 ha rape surplus<br>$xe_{11}$= 55 ha soybean surplus<br>→$xe_{12}$= 0 ha maize surplus<br>→$xe_{13}$= 0 ha sunflower surplus | 4)VDP (Marginal incomes)<br>$y_1$= 0 Lei income growth/ one more Diesel fuel liter<br>→$y_2$= 252 Lei income growth/one more Leu for expenditures with herbicides<br>$y_3$= 0 Lei income growth/ one more kg NPK<br>**$y_4$= 0 Lei income growth/one more Leu spent**<br>→$y_5$= - 13,180 Lei income growth/one more ha land<br>→$y_6$= - 1,260 Lei income growth/for the 181st ha with wheat<br>→$y_7$= - 850 Lei income growth/for the 84th ha with rye<br>$y_8$= 0 Lei income growth/for the 41st ha with barley<br>→$y_9$= - 780 Lei income growth /for the 61st ha with peas<br>→$y_{10}$= - 1,190 Lei income surplus/for the 131st ha with rape<br>$y_{11}$= 0 Lei income surplus/ for the 101st ha with soybean<br>→$y_{12}$= - 6,310 Lei income surplus /for the 201st ha with maize<br>→$y_{13}$= - 4,020 lei income surplus/for the 91st ha sunflower |
| FO Maxim (Income) = **2,210,750** Lei | |

Source: Own results.

## CONCLUSIONS

Digitalization in agriculture using new IT technologies could significantly contribute to the development of agricultural production and its economic efficiency.

In this article, a mathematical method from the field of "Operational Research" was combined to obtain the optimal economic variants in an agricultural vegetal farm.

The mathematical model method, accompanied by linear programming and simplex method and using the Solver tool from MS Excel Application, have quickly offered options for a farm manager to maximize the income under the optimization of the crop structure.

The result variants obtained could help the manager to forecast the possibilities of structuring the arable land for several crops chosen to be cultivated, considering the soil and local climate conditions.

The developed model has offered a possible solution through which all the restrictions were fulfilled with an optimal value of the objective function - Maximum net income. It should be noted that the entire arable surface was fully used.

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# STUDY ON THE PERCEPTION OF ROMANIAN FARMERS REGARDING THE FACTORS THAT INFLUENCE THE DEVELOPMENT OF AGRICULTURE

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***Abstract***

*Climate changes with their effects: floods, drought, desertification affect agricultural production. Likewise, the Agricultural Policies on the European Union, through the Farm to Fork Strategy, propose limiting the amount of fertilizers to improve the quality of the environment. Farmers must adapt and use high-performance technologies to face these challenges. In this context, the study analyses the perception of farmers with large farms regarding the main factors that influence the evolution of agriculture in Romania. According to the survey, the factors that influence the increase in agricultural production are: the use of selected seeds, adapted to the agricultural area where the farm operates, the establishment/expansion of irrigation systems, access to new research in the agricultural field, the increase in the level of training of agricultural personnel, the intensive application of fertilizers and pesticides, easy access to low- cost financing. Regarding the association in agriculture and ecological agriculture adapted to climate change, the farmers' attitude is polarized.*

***Key words*****:** *climate changes, certified seeds, genetic breeding techniques, irrigation systems, Romania*

## INTRODUCTION

The effects produced by climate change: drought, floods, desertification affect the agricultural activity [10].
The new CAP reform is based on Green Deal sustaining production, renewable energy resources, protecting environment and biodiversity assuring food security and safety [1].
Romania will implement the Agricultural Policy of the European Union, including the Farm to Fork Strategy, in order to reduce the amount of fertilizers and improve the quality of the environment [6, 4, 5]. The increase of energy and diesel prices will influence the efficiency of farmers' activity.
Adapting to these changes is essential for the survival of Romanian farms and ensuring food security [9].
Agricultural technologies are a main factor of influence on the agricultural performance [3, 2] and farmers' training level as well [8].
From this perspective, the study aims to highlight the factors that influence the evolution of agriculture in Romania, the perception of farmers regarding new agricultural technologies

## MATERIALS AND METHODS

The questionnaire was addressed to producers of cereals, technical plants and oil seeds in Romania and analyzed the perception of farmers with large farms regarding the main factors that influence the evolution of agriculture at the level of large agricultural holdings that grow wheat, corn, barley, sunflower, rapeseed, soybeans and potatoes.
The content of the questionnaire aims to analyze the farmers' answers regarding the following indicators: the importance of the criteria by which farmers select their input suppliers, the limiting factors that can contribute to the decrease in production, the factors that can lead to the increase in

productivity, the new improvement techniques based on high-performance technologies, the farmers opinions regarding the Farm to Fork Strategy [7].

The questionnaire was sent and completed by the farmers. The collected information was processed with the SPSS (Statistical Package for the Social Science) application, using the relative frequency of the analyzed indicators as a method.

The research was carried out between February and March 2022, on the number of 29 large and very large agricultural holdings in Romania. The holdings are part of the following counties: Giurgiu, Prahova, Constanta, Braila, Calarasi, Dolj, Ilfov, Tulcea, Olt, Arges, Vrancea and Ilfov.

Regarding the structure of the existing areas in operation by the responding agricultural producers, the situation is as follows: 17.2% of the holdings have an area of less than 200 hectares, 34.5% of the holdings have an area between 201 hectares and 500 hectares, 27.6 % of the holdings have an area between 501 hectares and 1,000 hectares, 17.2% of the holdings have an area between 1,001 hectares and 2,100 hectares and 3.4% of the holdings have an area between 2,101 hectares and 55,638 hectares.

## RESULTS AND DISCUSSIONS

### *1. Criteria for selecting input providers*

Proper selection of the input supplier is essential in increasing the productivity and competitiveness of the farm. According to the answers, an essential role in the selection of input suppliers is played by the history of seriousness between supplier and farmer (62%). Another essential criteria is the quality of inputs, adaption to the nutritional needs of the soil (58%).

The third essential element is related to the commercial aspects of the supplier-customer relationship: commercial discounts, promptness of deliveries, on the appearance of contracts.

Valuing social trust, based on the direct relationship between supplier and farmer, plays an important role in the selection process (Fig. 1) [11].

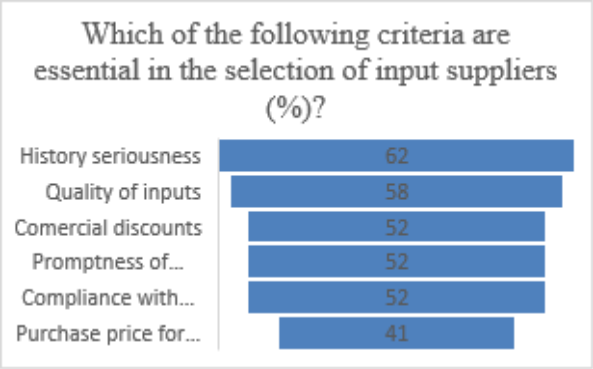


Fig. 1. Selection criteria of input suppliers
Source: Created by authors based on own data.

### *2. Limiting factors that can contribute to the decrease in production*

In order to identify the importance of limiting factors on agricultural production, the following were studied: climate change, lack of funding, drought, lack of skilled labor force, too heavy rainfall/puddles, desertification of land, lack of access to innovative technology or heavy access, treatments with fertilizers and pesticides underutilized, access to new agricultural research.

Thus, the farmers' replies highlighted the following:

**Climate change** is considered very important (69%) and important (20.7%) respectively as a limiting factor and with an impact in decreasing agricultural production (Fig. 2).

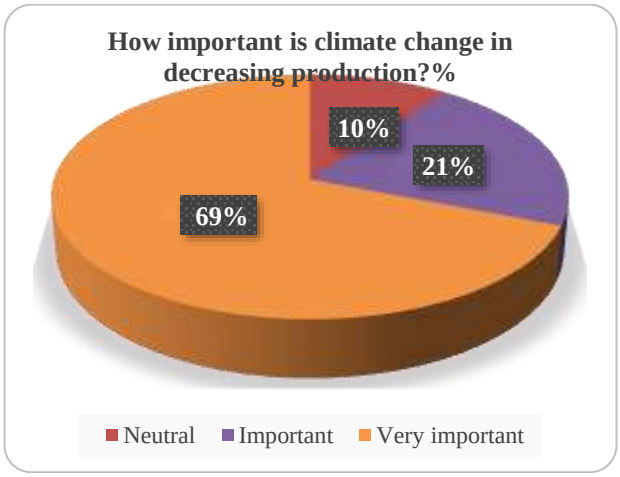


Fig. 2 Factor –Climate change
Source: Created by authors based on own data.

**Drought** contributes dramatically to the decrease in production and is considered very important (96.6%) by farmers (Fig. 3).

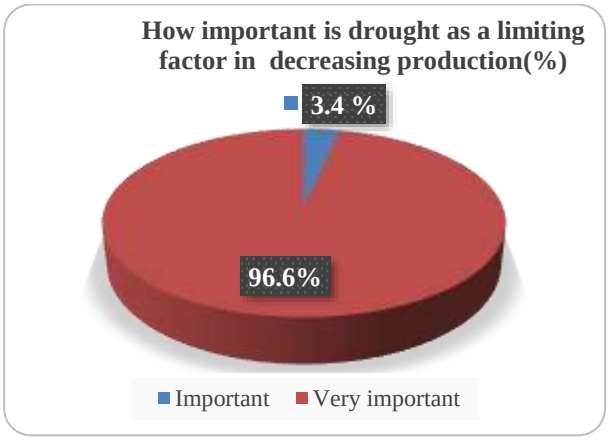


Fig. 3. Factor- Drought
Source: Created by authors based on own data.

**The lack of funding** is perceived as the least important factor for the decrease in production of 45% of farmers. At the opposite pole, 17% of them consider the lack of funding a very important limiting factor in the decrease in production (Fig. 4).

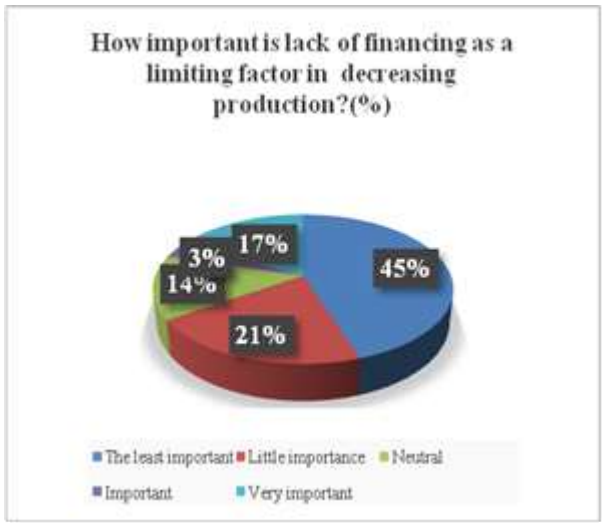


Fig. 4 Factor – Lack of funding
Source: Created by authors based on own data

**The lack of skilled labour** is perceived as a neutral factor in obtaining production by 27.6% of farmers. On the other hand, 20.7% of farmers consider it very important, while 24.1% of them think it is the least important (Fig. 5).

**Lack of access to innovative technology or heavy access** is considered a neutral factor by 28% of farmers.

On the one hand, the lack of access is the least important for 31% of farmers, while for 21% it is important for the decrease in production (Fig. 6).

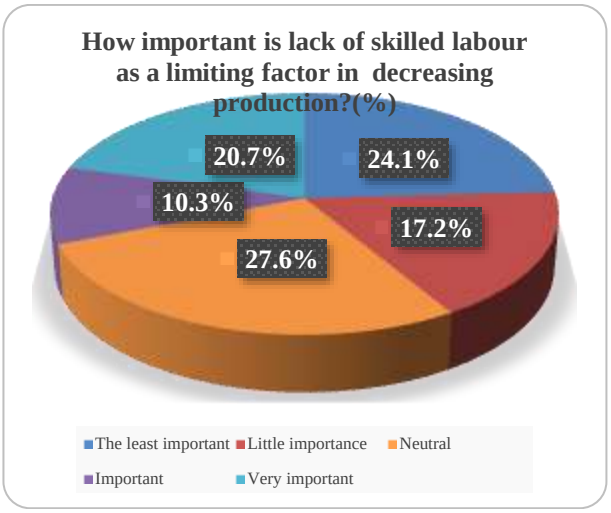


Fig. 5. Factor –Lack of skilled labour
Source: Created by authors based on own data.

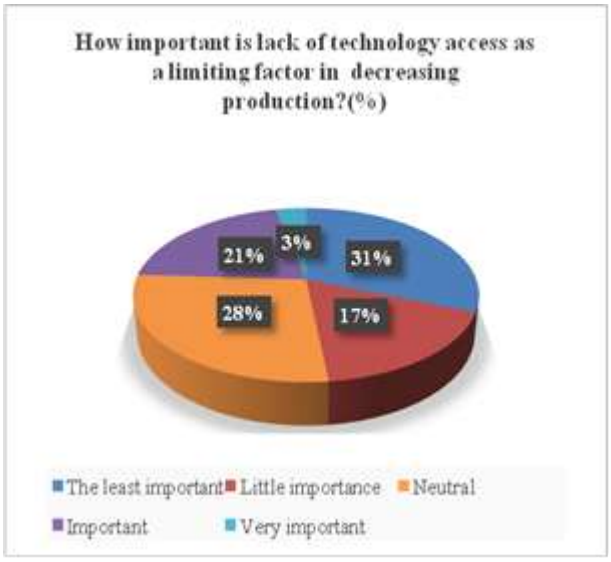


Fig. 6. Factor – Lack of technology access
Source: Created by authors based on own data

**The above-average heavy rainfall/pond** are considered the least important by 31% of farmers in decreasing production, while 24% consider them very important (Fig. 7).

**The desertification of the land** is considered the least important (34%) and, respectively, the least important (21%) in the decrease in production, on the background that this phenomenon manifests itself on a small scale at the level of Romania.

However, 14% of farmers consider it important and 7% very important with drastic consequences for production (Fig. 8).

**Treatments with too little-used fertilizers and pesticides** are considered a neutral factor for 21% of farmers.

On the other hand, 27% of farmers consider them to be the least important and 17% to be of little importance, while 21% of farmers consider them important and for 14% of them they are very important in decreasing production (Fig. 9).

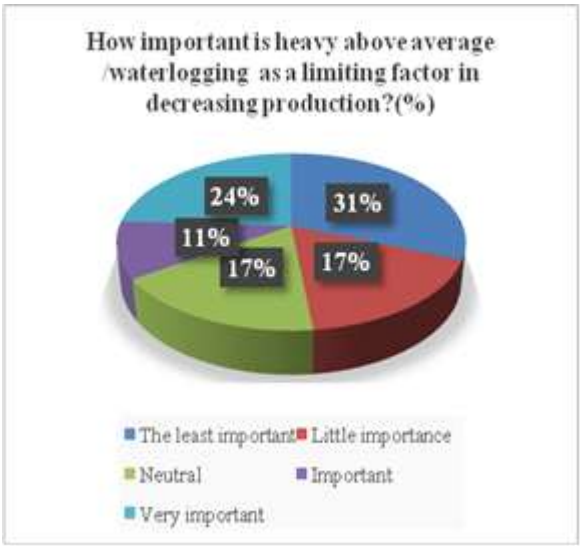


Fig. 7. Factor –Heavy rainfall
Source: Created by authors based on own data.

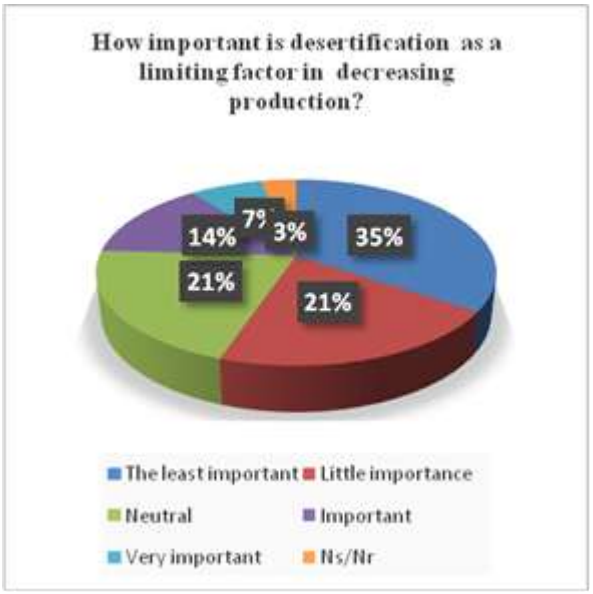


Fig. 8. Factor –Desertification
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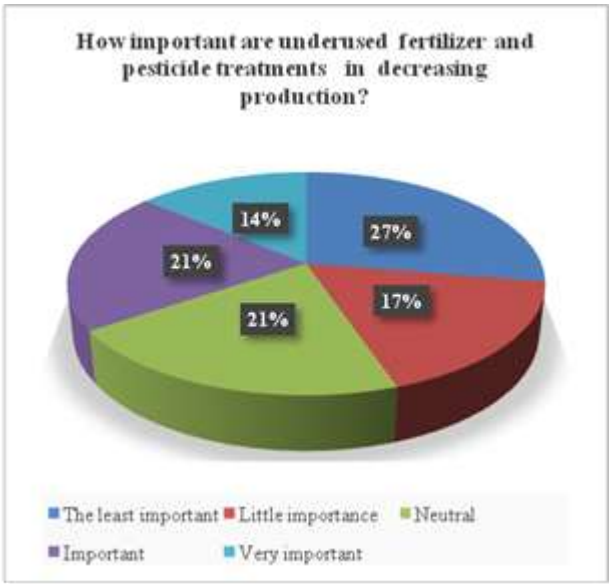


Fig. 9. Factor –Treatments with few fertilizers
Source: Created by authors based on own data

### *3. Factors that can contribute to the increase of agricultural production*

In order to identify the instruments by which agricultural producers can be supported in the successful achievement of sufficient agricultural production and of good organoleptic quality, farmers' responses on this issue were analyzed taking into account the following aspects:

-access to new agricultural research,
-the level of training of the personal,
-easy access to low-cost finance, -establishment/extension of irrigation systems,
-the use of selected seeds adapted to the agricultural area in which the agricultural holding operates,
- the intensive application of fertilizers and pesticides,
-climate-friendly organic farming and the association in agriculture.

Thus, in terms of **access to new research in the agricultural field**, it is considered important (27.6%) and very important (48.3%) by farmers in order to increase agricultural production (Fig. 10).

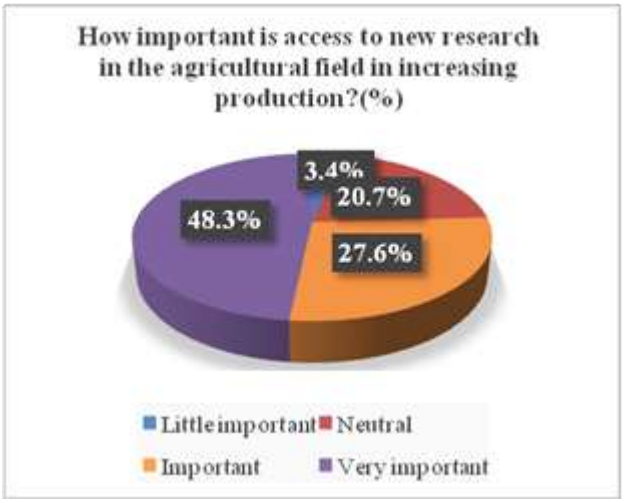


Fig. 10. Factor – Access to new researches
Source: Created by authors based on own data.

**Increasing the level of training of agricultural staff** is considered a very important condition for 38% of farmers, respectively important for 21% of them in order to obtain a better production (Fig. 11).

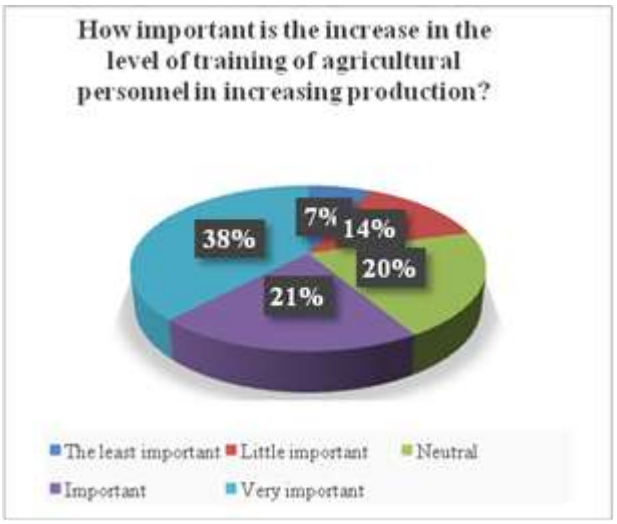


Fig. 11. Factor – Increase level of training
Source: Created by authors based on own data.

**Easy access to low-cost financing** is considered a neutral factor for 44.8% of farmers. On the other hand, 27.6% consider it very important, respectively 13.8% important in order to increase production (Fig. 12).

**The establishment/extension of irrigation systems** is considered a very important condition for 51.7% of farmers in order to increase agricultural production (Fig. 13).

**The use of selected seeds,** adapted to the agricultural area where the agricultural holding operates, is considered very important for 69% of farmers in order to obtain a better yield (Fig. 14).

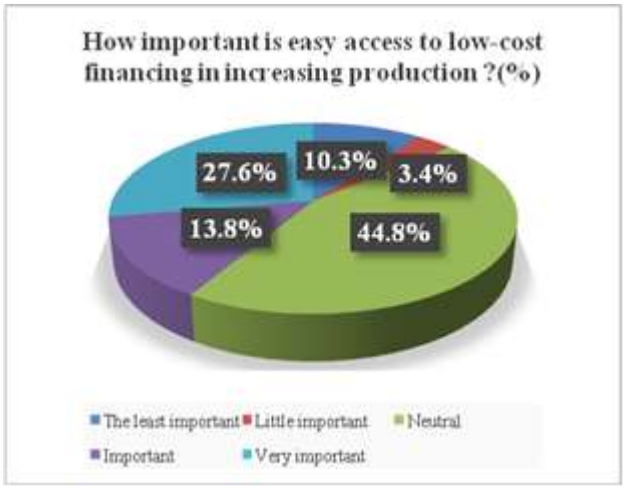


Fig. 12. Factor – Easy access to financing
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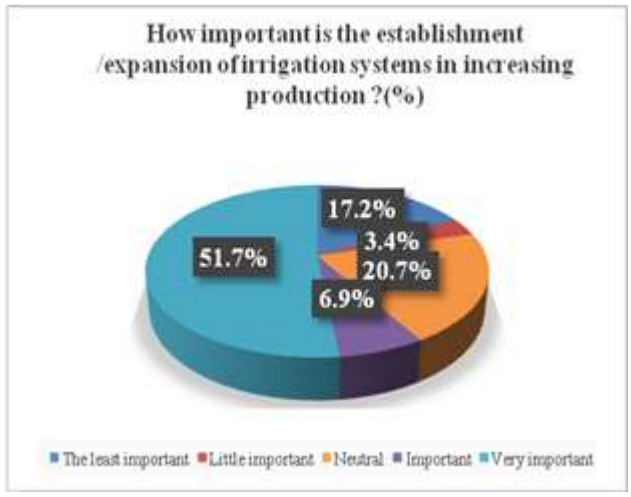


Fig. 13. Factor – Irrigation systems
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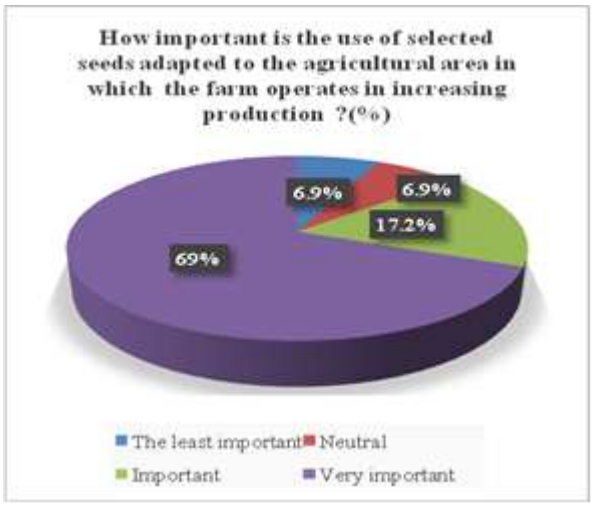


Fig. 14. Factor – Certified seeds
Source: Created by authors based on own data.

**The intensive application of fertilizers and pesticides** is considered very important (34.5%) and important (24.1%) respectively for increasing agricultural production (Fig. 15).

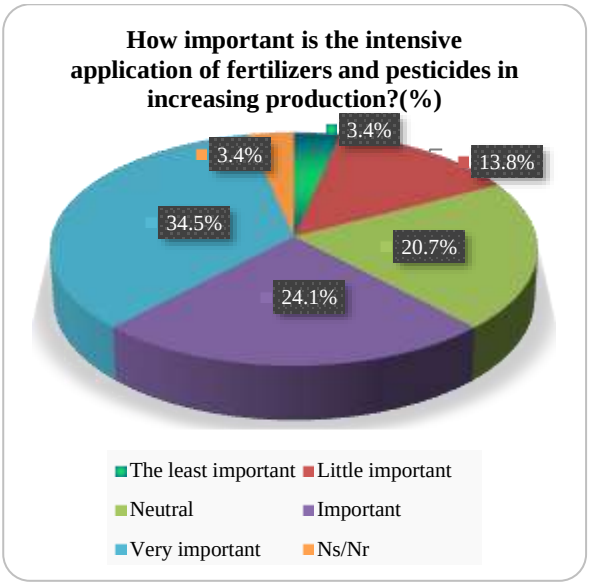


Fig. 15. Factor – Intensive application of treatments
Source: Created by authors based on own data.

**Ecological agriculture adapted to climate change** is considered the least important by 34.5% of farmers, respectively less important by 17.2% of them in increasing production. Moreover, 27.6% of farmers have a neutral position regarding the practice of ecological agriculture adapted to climate change (Fig. 16).

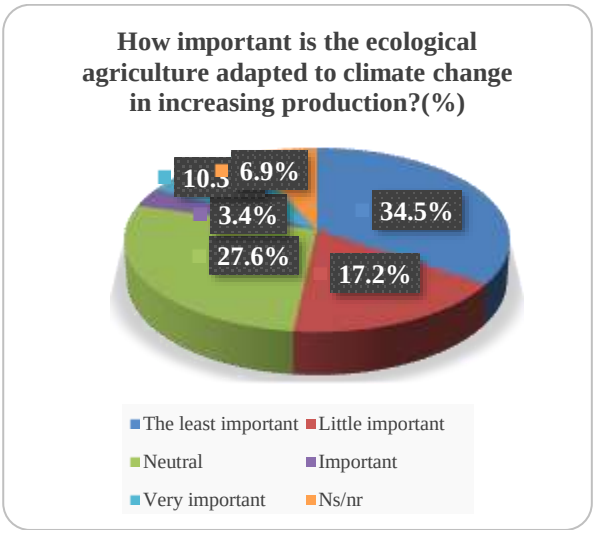


Fig. 16. Factor – Ecological agriculture
Source: Created by authors based on own data.

**Compared to the association in agriculture**, the attitude of farmers is polarized: 20.7% have a neutral attitude, 24.1% consider it important, 24.1% think it is very important, 17.1% consider it less important for increasing production (Fig. 17).

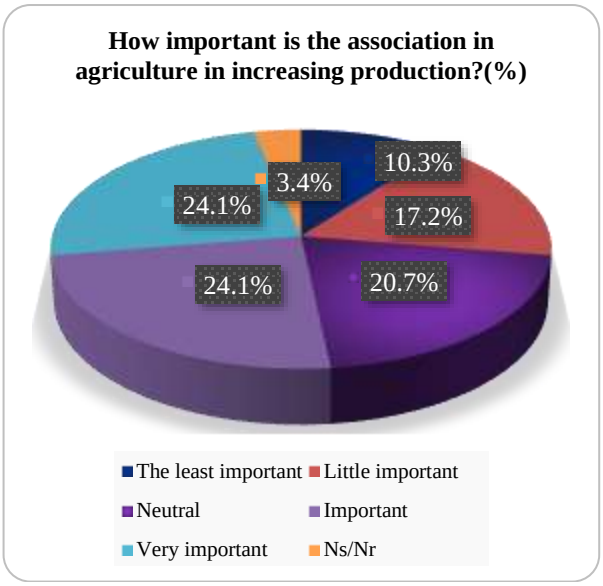


Fig. 17. Factor – Association in agriculture
Source: Created by authors based on own data.

### *4.New breeding techniques based on high-performance technologies*

Innovative technologies such as precision agriculture, digitization, genetic improvement techniques, certified seeds, the use of robots, drones as well as GPS, was the topic addressed in the questionnaire and to which farmers have the following perceptions.

**Genetic improvement techniques** are perceived as very important (69%) and important (20.7%) respectively by farmers. (Fig. 18).

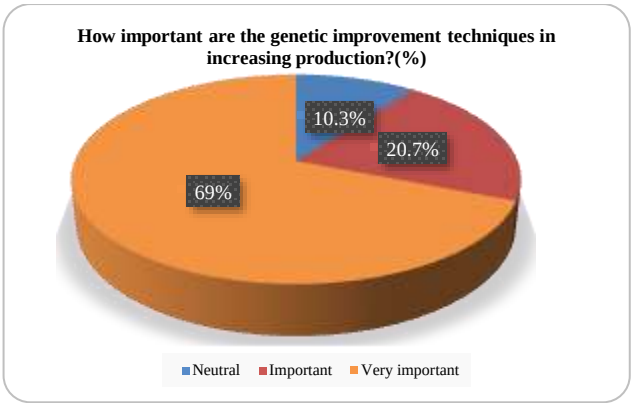


Fig. 18. Innovation – GIT
Source: Created by authors based on own data.

**Digitization** is considered very important for 31% of farmers and important for 20.7% of them. Also, 27.6% have a neutral attitude towards digitization.

The use of databases containing the assessment of climate and productivity parameters allows inputs to be applied in the optimal epoch and quantity (Fig. 19).

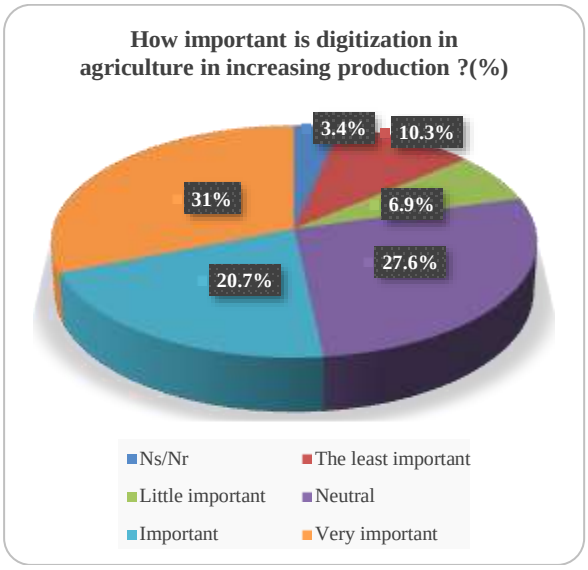


Fig. 19. Innovation– Digitization
Source: Created by authors based on own data.

**Certified seeds** are a very important factor (76%) and important (17%) respectively in increasing production for farmers (Fig. 20).

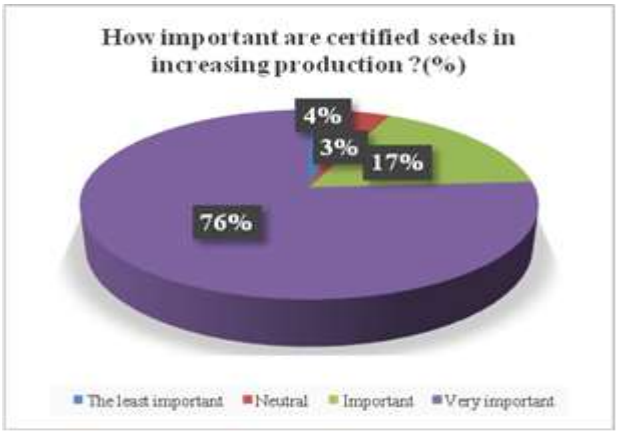


Fig. 20. Innovation Certified seed
Source: Created by authors based on own data.

Farmers believe that the use of **robots** to increase agricultural production is the least important (31%) and the least important (20.7%). Also, an important percentage (20.7%) have a neutral attitude. The use of robots in agriculture to obtain performance is important for 6.9% and very important for 17.2% of farmers, respectively (Fig. 21).

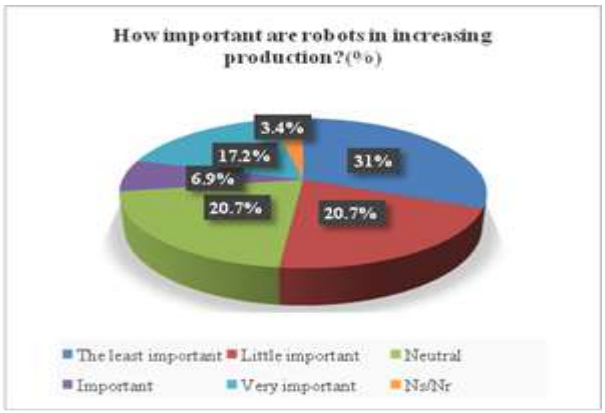


Fig. 21. Innovation – Robots
Source: Created by authors based on own data.

For the implementation of the precision agriculture system, it is necessary to monitor the crops by using aerial images that can be taken with the help of drones. Drones can also be used for the application of inputs, which leads on the one hand to the reduction of the quantities of pesticides, and on the other hand to the optimization of the use of inputs.

The use of **drones** in agriculture is the least important factor for 27.6% of farmers. Also 27.6% of them have a neutral attitude. Achieving performance with the help of drones is important for 10.7% of farmers and, respectively, very important for 20.7% of them (Fig. 22) .

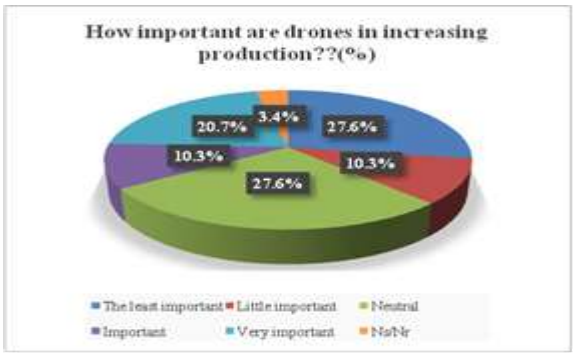


Fig. 22. Innovation – Drones
Source: Created by authors based on own data.

The use of GPS in agriculture is considered a very important condition (65.5%) and important (17.2%) respectively for increasing production (Fig. 23).

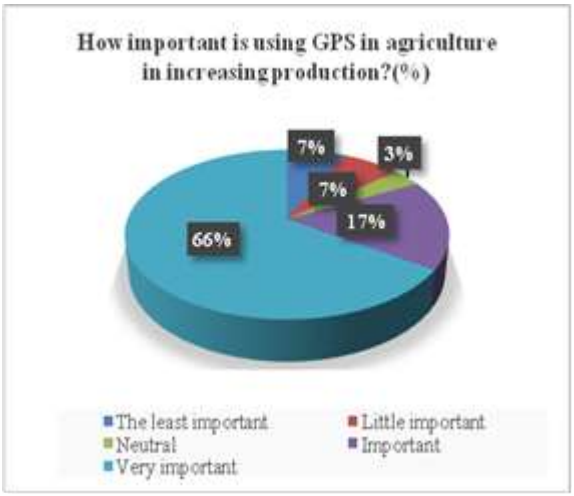


Fig. 23. Innovation – GPS
Source: Created by authors based on own data.

### *5. Farmers' views on the impact of implementing the Farm to Fork Strategy*

Regarding the perception of agricultural producers upon the impact of the Farm to Fork strategy on the activity of their own holdings and especially on agricultural production, the anwers were different and somehow contradictory.

A part of the farmers affirmed that, although they do not use quantities of pesticides above the recommendations and permissible doses, the impact of the reduction will be harsh, with effects in increasing expenses, reducing incomes and business profitability (Fig. 24).


Fig. 24. Farmers' opinions on Farm to Fork Strategy
Source: Created by authors based on own data.

## CONCLUSIONS

Agricultural producers consider drought and climate change to be limiting factors with a direct effect on the fall in production, with disastrous consequences for agricultural activity.

The factors that lead to the increase of agricultural production are, in descending order of importance, the following: the use of selected seeds, adapted to the agricultural area where the agricultural holding operates, the establishment / extension of irrigation systems, access to new research in the agricultural field, increasing the level of training of agricultural personnel, intensive application of fertilizers and pesticides, easy access to low-cost financing. Towards the

association in agriculture and organic agriculture adapted to climate change, the attitude of farmers is polarized.

The most important breeding techniques based on high-performance technologies are, in descending order of importance for farmers, the following: certified seeds, genetic improvement techniques, the use of GPS in agriculture and digitization. Compared to the use of robots and drones in agriculture, farmers have a polarized attitude.

Reducing the quantities of fertilizers, as stipulated by the Farm to Fork Strategy, will have a major impact on the level of agricultural productions and their quality as well as on farmers' incomes, quality of life and standard of living.

## ACKNOWLEDGEMENTS

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# IMPACT OF RURAL DEVELOPMENT PROGRAMS IMPLEMENTATION ON THE ECONOMIC AND SOCIAL EVOLUTION OF THE RURAL COMMUNITIES IN CĂLĂRAŞI COUNTY, ROMANIA

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***Abstract***

*Through this study, we have proposed as an objective, an evaluation of the impact that rural development programs have on the economic and social development of the rural environment, carrying out a case study in Călăraşi county. Thus, we monitored the extent to which the funds accessed by the Călăraşi County Council corresponded to the objectives assumed by our country through the Partnership Agreement with the European Union, respectively, whether the financing measures corresponded to the rural development needs of the analyzed county, through the portfolio of implemented projects in the programming period 2014-2020. The investigation methods used in the analysis process were, on the one hand, of a theoretical nature - consisting in the study of the specialized bibliography in the field of public administration, of funding programs from European or national non-reimbursable funds, but also of a practical - application nature - consisting of data collection, their analysis and processing in order to identify projects and financing programs from the portfolio of the Călăraşi County Council for the evaluation of the impact their implementation had on the overall development of the rural area of the county. Through this approach, we appreciate that the county institution is concerned with accessing non-reimbursable funds for the effective development of rural communities, making its mark in the promotion of cultural and natural heritage, in the development of transport and tourist infrastructure, in anchoring rural communities to the European economic and social space. Although in recent years, Călăraşi county experienced an important development regarding the accessibility, as well as the infrastructure of utilities and public services, the county remaining deficient in terms of port infrastructure, connectivity infrastructure with Bulgaria across the Danube, wastewater collection infrastructure and of waste.*

***Key words*****:** *development, European financing, project management, objectives, strategy .*

## INTRODUCTION

The collaboration of the Călăraşi County Council with territorial administrative units and co-financing of their projects has brought huge benefits to local communities, in terms of increasing the quality of local and county road infrastructure, social and cultural-educational services infrastructure [10]. We thus appreciate that the involvement of institutions with responsibilities in accessing and implementing funds with European and/or national funding has a great contribution in solving some local problems of the communities, which cannot be solved from the local budget funds [2].

In addition, in solving the infrastructure problem, Călăraşi County Council supported the administrative-territorial units in the county to apply, themselves, to the National Local Development Program, the National Investment Company (C.N.I.) and Anghel Saligny Investment Program to receive funding for the projects of roads, connection to the water/sewage network, rehabilitation/modernization/extension and endowment of schools, as well as those of construction/rehabilitation, modernization, endowment of cultural hostels [6]. Thus, the Călăraşi County Council created the possibility for administrative-territorial units to access a large part of the sums allocated to the county, the institution appealing to the Regional Operational Program to obtain financing for projects aimed at the energy efficiency of public buildings, road and educational infrastructure [13].

In the project portfolio of the Călărași County Council, environmental and green energy projects have been accessed and implemented, as well as in the field of socio-cultural and educational services, the development of tourism infrastructure. All these project ideas materialized much more easily by accessing European funds, which were adapted to the real needs of local communities.

Both Călărași County Council and the territorial administrative units ensured the citizens the right to participate in the decision-making process through a permanent public consultation process, to participate in economic progress through a perpetual process of social inclusion based on measures that allows disadvantaged people access to employment, to improve professional skills, as well as unrestricted access to health and educational services. Our recommendations aim, in particular, to continue efforts to increase the quality of road and educational infrastructure, as well as social and health services, both for the rural/urban population, but also the orientation towards the development of specific social services for vulnerable persons, with disabled, marginalized people in risk situations [7, 8].

It is appreciable that for the achievement of the project ideas of the territorial administrative units, Călăraşi County Council through its specialized apparatus and with the approval of the county councelors allocates amounts between 1,469,000 lei and 32,000 lei broken down from the value added tax to balance local budgets and broken down amounts from income tax [13]. Also, Călărași County Council distributes amounts from the fund established at its disposal of 6% of the income tax estimated to be collected from the state budget in 2022 for the co-financing of their investment projects [12].

These amounts allow project ideas to materialize and bring a new breath by relieving the own budget of these expenses. That is why the continuation of the granting process must be perpetuated for the benefit of the citizens of Călărași county.

## MATERIALS AND METHODS

Through the data collection and analysis process, we had the following objectives in mind: orientation and prioritization of the Călărași County Council in the development of project ideas with European or national funding; the correlation of these project ideas with the county's development strategy and the evaluation of the impact of the implementation of these projects on the development of the county; identification of risk factors in project implementation; the measures taken to increase the added value of the projects and to ensure their co-financing. [2]. In order to demonstrate the proposed objectives, the data collection activity was carried out at Călărași County Council, a public authority of county interest, which carries out activities in the field of local public administration, and which shows a special concern for the improvement of the living conditions of the county residents [5].

In order to identify the impact of accessing European funds and the implementation of national rural development programs on the economic and social development of the county, we consulted the representatives of the county institution involved in this process, who provided us with an analysis of the current situation and facilitated interviews with the mayors of the localities where such projects were implemented, steps aimed at obtaining information to substantiate the objective proposed in this study. The documents analyzed in the data collection process represent the 2014-2020 programming period and followed the Programs, Priorities and Financing Measures that were the basis of the implementation of project ideas in the county under study [12]. The investigation methods used in the analysis process are divided into two categories [1, 9]: theoretical methods - consisting in the study of specialized materials from the field of public administration, of financing programs from non-reimbursable European or national funds; practical - application methods - consisting in the collection of data, a process that proved to be a particularly important one in identifying the projects and funding programs of the

Călărași County Council and their impact on the economic and social development of the Călărași county.

## RESULTS AND DISCUSSIONS

Every approach of the territorial administrative units (municipalities), including the approach of Călărași County Council, is aimed at improving the live and living conditions of the local communities, avoiding disparities and social exclusion.

From the analysis carried out by us, for the purpose of carrying out this work, it follows that there is a lot of interest in the rehabilitation of the road, educational, social and environment infrastructure, through the financing programs intended for these purposes.

Starting from the programs and financing lines accessed, below we present the situation from the point of view of the assumed objectives, risks, constraints and consequences of the actions of Călărași County Council, as shown in Table 1.

Table 1. The general matrix of the impact of implemented rural development programs

| | ***Impact*** | | | | |
|---|---|---|---|---|---|
| ***Fields*** | ***Stakes*** | ***Risks*** | ***Objectives*** | ***Constraints*** | ***Consequences*** |
| *Road infrastructure* | Favorable geographical positioning, with good connectivity to the A2 motorway | Lack of financing | Sustainable development of county localities | Fragmentation of properties and the ambiguous situation on the legal regime of land | Deficient road infrastructure |
| *Social infrastructure* | Capitalizing on development opportunities | Non-allocation of the participatory budgeting tool | Accessing non reimbursable funds | insufficient allocated funds to national level for social infrastructure development | Poorly developed social assistance infrastructure |
| *Medical infrastructure* | Capitalizing on financing opportunities | Lack of professionals in the field | Ensuring some quality services, at high standards | Lack of needed funds | Unsatisfactory medical services |
| *Cultural infrastructure* | Development of leisure infrastructure | lack of solutons for spare time spending | Organization of shows and plays | Lack of needed funds | Lack of recreation spaces |
| *Environment infrastructure* | Capitalizing on the potential of renewable resources: solar energy, biomass | Lack of infrastructure for selective collection and capitalization of waste | Creation of infrastructure needed for selective collection | Non-application of the provisions of the integrated environment strategy at county level | Inefficient management of municipal waste |
| *Tourism* | Capitalizing on the existing tourist potential (leisure, cultural, business, scientific, sports tourism) | Lack of tourist accommodation units availability | Creation of some new accommodation facilities | Tourist offer of the neighbouring areas has a high attractivity degree | Insufficiently exploited tourist potential |
| *Digitalization* | Ensuring digital public services for citizens | Lack of financing | Creation of an integrated information system with role of Portal for citizens | Failure to capitalize on funding opportunities on time | Weak interest from citizens |

Source: Made by the authors based on information processed from Călărași County Council [2].

As shown in Table 2, a project of interest to Călăraşi County Council was the project "Modernization and rehabilitation of the county road DJ 306 section Cuza Vodă (DN3) - Socoalele - Ialomița county border km 0+000 - km 36+000", financed by the Regional Operational Program 2014 - 2020, Priority Axis 6/Investment Priority 6.1 which refers to the increase of road infrastructure of regional importance, respectively, to the stimulation of regional mobility by connecting the secondary and tertiary nodes of the TEN-T

The project will rehabilitate and modernize county road 306, km 0+000 – km 33+360, which runs on the territory of the localities Ceacu (Cuza Vodă commune) - Floroaica (Vîlcelele commune) - Dragoș Vodă (DN3A) - Socoalele (Dragoș commune Vodă) - Grădiştea - Independence - the border of Călăraşi county with Ialomiţa county.

The total value of the project is 53,815,805.32 lei, of which the amount of non-refundable financing requested is 53,614,940.79 lei.

Table 2. Impact of projects achieved under Regional Operational Program 2014 – 2020

| PROJECT TITLE | FINANCING PROGRAM | IMPLEMENTATION PERIOD | RESULTS/IMPACT |
|---|---|---|---|
| Rehabilitation and modernization of the county road in the area Cuza Vodă (DN3) - Socoalele | Regional Operational Program 2014 – 2020 | 15.04.2017-15.05.2020 | Significant improvement of the mobility of rural residents to the main national road networks and the A2 highway. Creation of 36 jobs for the residents of the area. |
| PROJECT TITLE | FINANCING PROGRAM | IMPLEMENTATION PERIOD | RESULTS/IMPACT |
| Increasing the energy efficiency of bodies A, B, C and D at the County Emergency Hospital "Dr. Pompeii Samarian" Călărași | Regional Operational Program 2014 – 2020 | 05.02.2020-05.03.2024 | Ensuring the energy efficiency of the public building "Dr. Emergency County Hospital "Pompei Samarian" Călărași. Creation of 15 jobs for the residents of the area. |

Source: Made by the authors based on information processed from Călărași County Council [2].

In the Development Strategy of Călărași County for the period 2021 - 2027, the construction of 250 km of roads connected to the TEN-T network, to be rehabilitated or modernized, and which lead, at least partially, to solving the problems related to transport, which represents one of the key socio-economic aspects of the county.

From the information collected, 93 km of roads were connected to the TEN-T network through rehabilitation and modernization, and action will be taken in this regard in the following period as well.

The county administration, as well as the administrative-territorial units (municipalities of the county) aim in the next period to facilitate quick and safe access to all areas and localities of Călăraşi county, in order to increase labor force mobility, improve living conditions and expand the environment business [4].

From our analysis it results that, up to this moment, 93 km of roads connected to the TEN-T network have been rehabilitated or modernized, the goal being that their value will increase in the next years. The county administration, as well as the administrative-territorial units (municipalities of the county) aim in the next period to facilitate quick and safe access to all areas and localities of Călăraşi county, in order to increase labor force mobility, improve living conditions and expand the environment business [4].

The actions foreseen in order to achieve this objective, as presented in Tables 3 and 4, aimed at:

-Achievement of Tourist leisure port;

-Achievement of Promenade;

-Achievement of bridge over Borcea branch;

-Achievement of ring road for Călăraşi municipality

- Achievement of ring road for Olteniţa municipality;

-Achievement of connection DN4 – DJ301 as a pass by Budeşti town;
- Construction of railway crossings on DN 21 in Drajna area, DN 3 in the Lehliu Gară area, on DJ 301 and Călăraşi municipality - Sloboziei street. An achieved objective was the rehabilitation, in the period 2014-2020, through the National Local Development Program (P.N.D.L.) of the ring road - the Ring Road.

Table 3. Impact of the projects achieved under Investment program the National Road Infrastructure Administration Company

| PROJECT TITLE | FINANCING PROGRAM | IMPLEMENTATION PERIOD | RESULTS/IMPACT |
|---|---|---|---|
| Construction of railway crossings on DN 21 in the Drajna area, DN 3 in the Lehliu Gară area, on DJ 301 and Călăraşi municipality - Sloboziei street. | Investment program National Road Infrastructure Administration Company | 30.09.2021-30.04.2023 | Streamlining of traffic by creating an overpass on DN21 with a length of 2.739 km. Creation of 48 jobs for the residents of the area. |

Source: Made by the authors based on information processed from Călărași County Council [2].

Table 4. Impact of "Anghel Saligny" Financing Program

| PROJECT TITLE | FINANCING PROGRAM | IMPLEMENTATION PERIOD | RESULTS/IMPACT |
|---|---|---|---|
| Building a bridge over Borcea Branch | Anghel Saligny | 18.11.2021-18.12.2024 | Ensuring the possibility of crossing Borcea branch by creating leisure facilities. Creation of 25 jobs for the residents of the area. |

Source: Made by the authors based on information processed from Călărași County Council [2].

The interest of Călăraşi County Council was also manifested regarding the modernization and rehabilitation of roads of regional and local interest, from the desire to bring as many roads of regional or local interest in Călăraşi County into good condition, so that they are created the premises of a sustainable economic development, including by exploiting the tourism potential of the area and the traditions of local communities.
The conclusion drawn from our analysis is that, during the period under evaluation, the total length of rehabilitated or modernized county roads was 149.85 km. In parallel, Călărași County Council supported the administrative-territorial units in the county to submit projects through the National Local Development Program, CNI, programs of national interest, which focused on road, sanitary, social, educational infrastructure and connection to the network of water/canal, as well as through the Regional Operational Program.
These actions were designed to support the development of road networks by modernizing alternative traffic safety systems, by creating alveoli and parking lots, roundabouts, traffic lights at congested intersections and making appropriate road markings.
Thus in the period subjet to evluation, there were achieved:
*Refuges on narrow or congested road sectors;
* Construction of parking lots and sidewalks in urban and peri-urban areas;
*Achievement of markings and road signs in accordance with the identified needs;
*Achievement of roundabouts in the agglomerations inside the localities, as well as at the crowded intersections of the external roads;
* Traffic lights at busy intersections in towns and cities.
Another notable objective of Călărași County Council was the modernization of the railway transport infrastructure by creating the premises for intermodal transport.
Thus, Ciulniţa Station and the railways that cross the county, as well as those that connect

the most important railway node in the area, are being rehabilitated. The purpose of the approach is to facilitate the access of people and goods, from the railway system to the naval system, by establishing a railway route to the Danube in Călăraşi muncipality, as well as by rehabilitating the railway that connects Olteniţa municipality with Bucharest.

The transport infrastructure was and is a priority for Călăraşi County Council, in view of the fact that it ensures the mobility of the labor force from the rural environment to the urban environment to the county municipality.

For this category of beneficiaries, Călăraşi County Council has taken steps to create bicycle paths that serve all areas of the city, by implementing the project "Promoting eco-tourism in Călărași Danube area through cycle tourism and the use of non-motorized fishing boats for the purpose of conservation the environment".

Another important objective of Călăraşi County Council and the administrative-territorial units in the county was the improvement of the critical technical-building infrastructure for the county: public utility networks by increasing the quality of life of the county's residents. At the level of the communes in the county, multiple interventions were carried out aimed at the modernization and expansion of public utilities [11].

Through this objective, one of the most important weak points identified in SWOT analysis was and is being tried to be treated, which reflects the communities reduced access to water and wastewater infrastructure, the inadequate quality of drinking water and the lack of sewage and sewage treatment facilities of wastewater in certain areas (especially rural). In Călăraşi county, there is a large regional operator in the field of water management, which has expanded its activity to the territory of Ialomiţa county. The final goal is to cover all towns, communes and as many component villages as possible with complex and modern public utility services.

The development of tourism through an integrated approach involving a high quality of services, accommodation conditions, labor force, transport, environment and general ambience is also a priority [3].

Through its development, tourism contributes to the economic, social and environment well-being of the county, and through its geographical location, with a particularly attractive landscape, created by the presence of the Danube, with its wild forests and its rich fauna, with strong historical resonances and ethnographic, Călăraşi county offers an incredible potential for tourist development, insufficiently exploited.

Table 5. Parallel between the program and the financing lines related to the periods 2014-2020, respectively 2021-2027

| **Programele și liniile de finanțare aferente perioadei 2014-2020** | **Programele și liniile de finanțare aferente perioadei 2021-2027** |
|---|---|
| Regional Operational Program (POR) | National Recovery and Resilience Program (PNRR) |
| Large Infrastructure Operational Program (POIM) | Operational Program Sustainable Development (PODD) |
| Administrative Capacity Operational Program (POCA) | Operational Program Transport (POT) |
| Interreg VA RO-BG | Operational Program Smart Growth and Digitalization (POCID) |
| National Local Development Program (PNDL) | National Health Program (multifond) (PNS) |
| The National Investment Program of the National Investment Company (CNI) | Operational Program Human Capital (POCU) |
| The National Housing Program of the National Housing Agency (ANL) | Integrated Territorial Development Operational Program (multifond) (PODTI) |
| Tourism action funding program of the Ministry of Tourism (MT) | Regional Operational Programs – implemented at region level (8 POR) |

Source: Made by the authors based on information processed from Călărași County Council [2] .

The comparative situation of the Operational Programs through which economic and social development projects were financed in Călărași County, respectively, the period 2014-2020, with the period 2021-2027 is presented in Table 5.

Based on the eligibility conditions of Călărași County Council and the administrative-territorial (commune) units, there is still the possibility of accessing them for the development of the communities of Călărași county.

Analyzing the situation, it is further observed that the concerns of Călărași County Council were also aimed at improving the institution capacity to provide transparent services, by carrying out an institutional-level analysis through which vulnerabilities were identified and corrected, as well as by improving the knowledge and skills of employees, local elected officials/officials in this area.

## CONCLUSIONS

From this analysis, it resulted that special emphasis was given to the Regional Operational Program 2014-2020 (33% of the implemented projects), through which problems related to road, health and social infrastructure were solved. In addition, in continuation of this approach, the institution appealed to national funding sources (PNDL, CNI, ANL, Ministry of Tourism, representing, in total, 35% of the implemented projects). Another concern of Călărași County Council concerned the integrated solid waste management system in Călărași County by creating a selective waste collection platform in Ciocănești commune through the Large Infrastructure Operational Program (POIM 20% of implemented projects). The project continues, in stage II and in the current programming period.

The conclusion that emerges is that the approach of Călărași County Council was that its interventions cover as wide an area as possible of the investment priorities accessed. Starting from the conclusions drawn and taking into account the particularities specific to the local context of the county, we propose that the Strategy of Călărași County Council for rural development includes:

(i)Continuation of digitization of public services intended for citizens and for administrative-territorial (commune) units in the county

(ii)Stimulating and supporting agriculture and animal husbandry, the local business environment, thus offering a good potential for growth and development of local communities

(iii)Investments in human capital, as the main condition for obtaining economic performance through actions in the area of education, actions reflected in the quality of education, which is closely linked to the job market

(iv)Increasing the quality of housing and reducing the gaps between communities by stimulating investors and creating the necessary jobs

(v)Accessing non-refundable European funds for the integration and empowerment of Roma citizens.

(vi)Capitalizing on the tourism potential of local communities by investing in *creating recreation and leisure facilities.

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# ESTABLISHING A NETWORK OF COMMUNICATORS AS AN ENGINE FOR THE DEVELOPMENT OF NATURAL GRAZING ACTIVITIES

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***Abstract***

*The development of communication networks has an increasingly important role in the development and modernization of the fields of activity of agriculture. This trend has effects between different actors in the production chain and creates a tighter connection between the stages of land cultivation or the maintenance of natural pastures, ecological grazing, milk, and meat production, respectively the preparation of the final products and their distribution, including marketing techniques. In the paper, an analysis will be made of the specialized publications in the field of Agribusiness in Romania and the effectiveness of the various communication channels used in the present will be discussed with the aim of contributing to mitigating the current problems of natural grazing activities and identifying the main pillars of development and progress. This research paper utilizes an academic research methodology aiming to highlight the importance of communication networks in promoting natural grazing activities. The results of the study demonstrate that the establishment of networks can significantly contribute to the modernization of the Romanian agricultural sector, aligning it with the principles of sustainable competitiveness and resilience. In conclusion, this study provides evidence that the establishment of such networks is essential for the development of a sustainable and resilient agricultural sector in Romania.*

***Key words*****:** *natural grazing, communicator network, dissemination of Information, sustainability, rural development, agribusiness*

## INTRODUCTION

The importance of establishing natural grazing activities as a means of promoting sustainable land use and conservation has increased. However, the success of these activities depends on effective communication between stakeholders, such as landowners, farmers, conservationists, and researchers. This article emphasizes the significance of establishing a network of communicators to drive the development of natural grazing activities. It discusses key stakeholders, communication channels, decision-making processes, and opportunities for continuing education and training. The article also highlights the benefits of leveraging existing networks and partnerships to promote the success of natural grazing activities. By creating a network of communicators, all stakeholders can work towards the same objectives and foster sustainable land use and long-term conservation. Similar research in the field of natural grazing shows their importance as a resource of animal feed but recently we are witnessing a significant degradation of this resource due to disastrous management. (Iagaru et al., 2015) [3].

Van den Pol-van Dasselaar A's research indicates that a discernible pattern of declining grazing practices is prevalent throughout Europe, which presents significant challenges as grazing provides various ecosystem services that are highly regarded by a wide range of stakeholders (van den Pol-van Dasselaar A, et al., 2020) [10]. All ruminants used to graze as their main method of nutrition. Grazing enables the most natural

management of animals. Many segments of European society clearly favor grazing, according to citizen surveys (Jackson, et al., 2020) [4].

Grazing-based production systems have the ability to produce high-quality foods like milk and meat while also having a favourable impact on a variety of socioeconomic and environmental factors because of their multifunctionality. Many studies have demonstrated the beneficial impacts of grazing on agricultural revenue, biodiversity preservation, carbon emissions reduction, protection of cultural landscapes, improvement of animal welfare, suppression of wildfires, and food safety. (van den Pol-van Dasselaar A, et al., 2020) [10].

The paper is a part of the research project Grazing4AgroEcology (G4AE), funded from the EU's Horizon Research and Innovation Programme, that aims to support farmers in optimizing grazing for the environment, animals, and society, while producing healthy food with less impact on natural resources [2]. It seeks to use a clear multi-stakeholder approach that aims to restore farmer and agricultural industry confidence in production performance and grazing competitiveness by addressing the entire Agricultural Knowledge and Innovation System (AKIS), including science and practice, Operational Groups (OGs), non-governmental organizations (NGOs), advisors, as well as consumers and citizens.

The approach of the project will aim to enhance the role of grazing in supporting the objectives of the Green Deal and the Farm to Fork strategy. One of the project's key concepts involves establishing a link between editors, specialized publications, newsletters, and newspapers in the grazing sector from partner countries, namely France, Germany, Ireland, Italy, the Netherlands, Portugal, Romania, and Sweden. By creating this network of communication, the research team seeks to foster greater awareness and understanding of grazing practices and their potential benefits, and to encourage knowledge-sharing and collaboration among stakeholders in the field. As a result of this idea, an inventory of this information will be made, which will be published in the form of a single newsletter for grazing store" which will be synthesized in an aggregated newsletter that will be launched at least 4 times/year using a common template.

## MATERIALS AND METHODS

The Materials and Methods chapter outlines the specific materials, instruments, and procedures used in the study under investigation. This section provides a clear and concise description of the methods employed to gather, process, and analyse the data. The Materials and Methods section into two parts, the first part emphasis the existing papers in this topic while the second part of the Materials and Methods chapter involved the creation of a persuasive document aimed at encouraging publishers in the field to participate in the project. To explore the importance of establishing a network of communicators as a driver for the development of natural grazing activities, a review of relevant literature was conducted. A search of academic databases (e.g., Google scholar, MDPI, Web of Science) was performed using keywords such as "natural grazing," "communication networks," "Agroecology," and "sustainable land use." The search was limited to articles published between 2010 and 2023. Articles were included if they discussed the establishment of communication networks as a means to promote natural grazing activities or if they provided relevant examples of successful networks in the agricultural sector. To ensure a comprehensive coverage of the topic, relevant articles from other countries were also incorporated into the study, with a particular emphasis on countries sharing similar agricultural systems and facing comparable challenges to those in our study area. The same search strategy described earlier was employed to identify the relevant literature.

About 17.34% of the national grassland area is part of the Natura 2000 protected sites which are designated as protected areas, however, this area is currently degraded mainly due to excessive grazing, as

highlighted by Roman et al. (2019) [7]. Due to the traditional practices of small-scale agriculture that persisted for a long time in Romania, natural, biodiverse grazing areas were still preserved, but now they are threatened by the recent intensification of land use.

According to a study carried out based on a survey in the agribusiness environment in Romania, the increased use of IT tools (software and hardware) is a determining factor for the professional success of actors in the field of agriculture (Tudor and Sipica, 2012) [9].

The situation of farms and holdings in Romania was studied by researchers who used statistical methods to determine the evolution of the main indicators such as the dynamics and structure of the number of holdings, the agricultural area used, standard production, the average size of the farm in terms of area land and standard production (Popescu et al 2016) [6]. They concluded that the number of farms is decreasing, the average farm size has increased, but the economic efficiency of Romanian agriculture is the lowest in the EU. A possible path towards the development of a modernized Romanian agricultural sector, which meets the criteria imposed by sustainable competitiveness and resilience, both by using existing agricultural technologies in farms to their maximum potential, and by increasing the number of young people involved in the agricultural sector is the establishment a communication network to ensure the acceleration of farm development and the digital transformation of Romanian agriculture.

Certain species of birds that live in grasslands are in rapid decline, in part due to the degradation of their breeding habitat as private landowners reduce the heterogeneity of crops to obtain large amounts of feed for cattle (Sliwinski et al., 2018) [8]. Natural grazing involves keeping several species of grass and shrubs, which increases the level of biodiversity. Also, the green leaves of the shrubs can serve as food when the grass is not growing.

Natural meadows represent an ecosystem that is prone to degradation if the pasture management is inadequate (Maruşca et al., 2021) [5].

In order to achieve the Newspaper task of the project it nominated a “Communication Officer” from each partner country. Following a meeting of the communication officers it was elaborated the “Collaboration letter” document. In this letter of intent, it is being informed about the Grazing4AgroEcology (G4AE) project and its collaboration and networking opportunities for journalists, authors, and publishers. It is stated that the project is a consortium of 18 partners, including farmers' organizations, extension services, education, and research institutions in eight countries (France, Germany, Ireland, Italy, the Netherlands, Portugal, Romania, and Sweden), and is a HORIZON Europe funded project. The partnership aims to create a European Network to promote grazing and support grazing-based farms on their economic and ecological performances and on animal welfare. Together with the network of 120 partner farms (15 per country), the capture and implementation of best practices and innovations to promote grazing will be enabled. It is mentioned that to highlight and share the best grazing practices at European level, an inventory of existing content in the field will be created. This inventory will be published on their website and promoted via all their channels. The so-called “One-stop newsletter” will gather grazing-related expertise from different countries and enable researchers and farmers to address the major natural, scientific, and technological challenges through knowledge transfer. It is stated that the project aims to bring added value to both the consortium and the collaborators with whom they want to create a solid and sustainable partnership. Therefore, they offer access to a large and exclusive European network built in the grazing sector, direct interaction & exchange with other authors facilitated through dedicated events, increased visibility of authors and their published materials in at least 8 countries by presenting their biography, activities and work on their website, and increased impact of work through access to new and international databases and an online repository of

knowledge related to innovations in grazing. The involvement of collaborators entails providing information/articles or journal entries that they wish to promote and permission to use summaries of published materials or if for certain materials no summaries are published to allow them to do their own summarization of the materials, all such extracted information will be centralized in a common newsletter. Collaborators are expected to participate in one or two bilateral meetings with the project team to discuss the optimal way of collaboration and participation in two events dedicated to authors so far as these events are of interest to them.

In many fields, the Slow philosophy of action has appeared for the purpose of sustainable development, for example Slow Food and Slow Tourism. For the field of breeding farms, EFNCP is the only European organization that focuses on maintaining low-intensity animal breeding. In this way, besides the reintroduction of less productive lands in many European countries into the grazing circuit, the most important results are the conservation of biodiversity, the avoidance of desertification, the sequestration of carbon in the soil and the prevention of wildfires.

The primary objective of forming a network association is to amplify representation and ensure that agricultural systems with "high natural value" (HNV), such as traditional pastoralism, are no longer subjected to discrimination by policies like the Common Agricultural Policy (CAP).

By establishing such a network association, agricultural practices with high natural value in Europe will be able to maintain a sustainable economy and grow through consistent economic incentives and practical support.

In accordance with the objectives of the strategy for research - development - innovation in the agri-food field in the medium and long term 2020 - 2030 and according to the specialty works developed by the university environment, agricultural universities must generate high-quality scientific knowledge, in order to accelerate the transfer of agricultural knowledge - biotechnology in innovation (Fintineru et al., 2013) [1].

The general goal of the group of authors of this work (belonging to USAMV, ATC, G4AE members) EFNCP is to promote and implement actions to increase the capacity of agricultural farms with high natural value and those with traditional pastoral practices in Romania.

The directions of action to achieve this goal are:

-The proposal for legislative changes at the level of the Ministry of Agriculture and Rural Development in Romania to create a support framework for farmers practicing agriculture with high natural value.

-Analysis of the problems faced by small farmers who use traditional methods and how they apply for the financial incentives that are currently available.

-We support and offer specialized training through various university programs or at the Cluster level to increase the level of knowledge and encourage the inclusion of youth in traditional practical castes.

-We propose establishing and increasing the degree of use of networks among farmers, ecologists, and decision-makers.

## RESULTS AND DISCUSSIONS

The communication strategies for the development of different practices in agriculture extend from the management of advocacy campaigns, i.e., the organization of demonstrations or street protests as a sign of revolt, and up to the use of communication networks to promote positive changes and increase awareness of various issues related to the importance of preserving natural pasture.

The results chapter of this article provides a detailed analysis of the study's findings. As mentioned, in the previous chapter a collaboration letter was sent to the communication officers in order to be sent to the national editors. The national editors showed their interest to be part of this research and to provide access to valuable information in the domain of sustainable grazing. Following a discussion with the national editors from Romania, it was found

out that the fact that attracted them most was opening to a new audience, having visibility on the website and where the article will be available in the 8 partner countries and the information translated into each national language. Moreover, the publishers mentioned the exchanges of experience with other publishers and the interaction with topics of interest that may not have been addressed by their own publisher.

Another result of this task is the first newsletter, which was launched late January, and disseminated in all the partner countries. The table of content of the first newsletter contains the following: About the project, G4AE stakeholders' benefit, project insights with the Project Manager, project insights with the Work Package two leaders, Meet the partners, Forthcoming Activities, and Contact us.

In the introduction it starts by explaining that The Grazing4AgroEcology consortium has released its first newsletter with insights into their ongoing project. The consortium includes 18 partners from eight EU member states and represents various grazing practices and pedo-climatic conditions in Europe. Their aim is to put grassland knowledge into practice to support farmers with the involvement of the whole agri-food sector, NGOs, and society. They invite readers to join them on this journey.

The Project introduces the readers to the topic of the newspaper by presenting That the Grazing4AgroEcology project, aims to support farmers in implementing grazing-based systems that produce healthier food and have less impact on natural resources. The project will target the EU Green Deal objectives related to biodiversity restoration, nutrient loss reduction, and greenhouse gas emissions reduction. The G4AE project intends to adopt a multi-actor approach that encompasses various stakeholders, including farmers, industry representatives, educators, researchers, advisors, and members of society. By encouraging co-creation and knowledge sharing, the project aims to enhance the adoption of innovative practices and facilitate the transfer of best practices and innovations.

The G4AE stakeholders benefit section starts with The project aims to provide added value to both the consortium and its collaborators by creating solid and sustainable partnerships. The project offers advantages to three types of stakeholders: general stakeholders, farmers, and young farmers.

Advantages to general stakeholders and farmers, including access to a European network in the grazing sector composed of young farmers, partner farms, facilitator agents, and scientific and technological working groups. The project also aims to create synergies and collaborative relationships with other European stakeholders to find solutions to specific grazing problems. Through the project, stakeholders can increase their visibility in the eight partner countries, gain access to an online repository of knowledge related to innovations in agroecological grazing and participate in dedicated events and multinational exchanges of experience. The project also offers opportunities to participate in farm walks and demonstrations hosted by innovative farmers, travel abroad to visit innovative farmers and exchange knowledge, learn how to assess farm sustainability and the impact of innovations on ecosystem services and farm profitability, and develop strategies to promote their own business through video-making and storytelling.

The Grazing4AgroEcology project also offers several advantages to young farmers, including the opportunity to use innovative learning and communication methods such as digitalization, be part of national and European young farmers group network, and meet other young farmers in national meetings. The project encourages young farmers to give input in discussions within young farmers groups, be supported by inspiring mentors, and feed the development of the project with their needs and opinions. Additionally, young farmers have access to useful outputs for the young farming community, educational materials related to grazing-related innovations, and interactive training events on grazing held by international and national experts. Furthermore, they have access to international

multi-day grazing tours that offer mutual learning in an interactive way through farm visits, training, and discussions. The project also provides access to an international grazing network of young farmers, acting as ambassadors for grazing in their own countries.

The highlights of the project Insights

Question: *What are the new inputs in this project and which do you think will contribute the most to its success in the future*?

Answer: Innovation in the grass-based system is much more complex and challenging than in any other type of farming system. The new input of G4AE is the integrated innovation approach through co-creation. Our 3-tier multi-actor approach based on co-creation and knowledge sharing will actively involve all relevant actors of the grazing AKIS.

Question: *As its project coordinator, what are the anticipated challenges/barriers/blocks that could be faced by the consortium during the implementation of this project*?

Answer: Integrating the entire sector with all types of stakeholders means the integration of different expectations, viewpoints, and constraints. It will be a challenging task to keep all on board and to ensure equal engagement. In our G4AE network, we will implement a set of 18 so-called "Facilitator Agents" who are specifically dedicated to this task of mediating and moderation. Additionally, there may be challenges related to language barriers and cultural differences among the partner countries. We will work to overcome these challenges by providing translation services and cultural training to ensure effective communication and collaboration. Another potential challenge is the availability and accessibility of data, especially related to farm performance and ecosystem services. We will work closely with farmers to collect and analyze data in a way that is feasible and meaningful to them. Finally, there may be challenges related to funding and resource allocation, but we will work to ensure efficient use of resources and seek additional funding opportunities as needed.

Question: *What is the role of the partner farms and how can other farms benefit from the results of the project*?

Answer: Farmers are central to the project which has a bottom-up approach. There are 15 Partner Farms in each national network, and they will be the source of the best practices and innovations to enhance productivity, economics, ecology, cultural and societal values on grassland farms nationally, and across the project MS. The Partner Farmers will make short practice videos and provide information for practice abstracts that will be shared through the project network for the wider farming community.

Question: *What are the biggest challenges for WP2 in your perspective as a coordinator*?

Answer: One of the biggest challenges will be maintaining active and engaged Partner Farm Networks throughout the project. The Facilitator Agents will have a huge role to play here

The newspaper ends by telling the reader that We are focusing on building the network of partner farms and creating the first synergies in the coming period.

## CONCLUSIONS

Communication is one of the no regrets methods for changing agriculture for progress and the gateway to new resources and opportunities. It connects the key players in agribusiness, makes their dialogue heard and empowers marginalized communities, small farmers who use neutral grazing methods to influence financing decisions that help these practices economically.

Addressing the problems of pastures in an organized way and describing the activities of the network of communicators in a magazine is a source of good practices that can inspire farms all over Europe.

The article emphasizes the importance of effective communication between stakeholders to promote natural grazing activities for sustainable land use and conservation.

A review of relevant literature highlights the importance of communication networks in promoting natural grazing activities. The

establishment of such networks can contribute to the development of a modernized Romanian agricultural sector, which meets the criteria of sustainable competitiveness and resilience.

The Grazing4AgroEcology consortium has released its first newsletter, which provides insights into their ongoing project. The project also provides access to an international grazing network of young farmers, acting as ambassadors for grazing in their own countries. Challenges related to language barriers and cultural differences among the partner countries will be overcome by providing translation services and cultural training.

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# AGRICULTURAL PRODUCERS' STRATEGIC MARKETING TRANSFORMATION TOWARDS SUSTAINABLE PATTERNS IN THE CONTEXT OF ACHIEVING HIGHER PRODUCT PERFORMANCE

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***Abstract***

*The purpose of this paper is to provide an insight into the influence of certain elements of sustainability included in marketing strategies of agricultural companies as the main prerequisite for achieving greater efficiency of their products. Strategic marketing transformation is the result of transformation of organizational culture mediated by market orientation. This research uses a quantitative approach, a stratified proportional random sampling method, with a sample size of n = 147 respondents. The main primary research was conducted using the survey method on a sample of respondents in the Republic of Croatia. For the analysis and processing of the collected data, descriptive analysis, measure of central tendency, measure of dispersion, measure of asymmetry and roundness, then bivariate analysis, and multivariate methods were used. The results of the research confirmed the multidimensionality of the product's effectiveness. The performed regression analysis shows the existence of predictive ability of appropriate elements of marketing transformation in the process of defining and offering effective products on the market ($p < 0.001$). This knowledge would be useful to agri-food entrepreneurs in the context of defining effective and competitive marketing strategies as an opportunity for development and their economic prosperity.*

***Key words*****:** *agricultural producers, strategic marketing transformation, sustainable patterns, product performance*

## INTRODUCTION

It is very certain that the key to the successful market positioning of any successful business entity, as well as the aging of its competitive advantage, is a well-prepared and elaborated marketing strategy (Saqib, 2021) [18]. In the context of market orientation, this should be the primary effort of enterprising and successful managers who run either large systems or small companies, regardless of the sector or industry in which they operate. Therefore, the marketing strategy is an important component of the overall business strategy that should not be neglected at any stage of the business. Also, a shift in the development of the marketing paradigm is more than evident as a result of the times and conditions that have been set not only in front of the corporate world, but also in general the conditions of modern development of human society in general. In this sense, sustainable development should be mentioned, as a new pattern of economic development, so accordingly marketing itself had to undergo some kind of changes (Au-Yong-Oliveira and Sousa, 2022) [2]. It can be argued that marketing is in a phase of a kind of evolution, it is being fundamentally reconsolidated as a response to sustainability practices. Therefore, this means that for the development of marketing strategies, it is mandatory to include certain elements of sustainability that will be clearly manifested in strategic marketing practices and the marketing mix (Morgan et al., 2019) [13]. But, on the other hand, it is not easy to define and implement, because the consumer is the one who represents the central component and marketing organizations must adapt to his newly created consumer patterns, wishes and needs (Mazurek-Łopacinska et al., 2022) [11]. Therefore, the integration of sustainability into the marketing strategy is another unique task and goal. On the other hand, a sustainability marketing strategy not only results in added value for the consumer, but also in building long-term relationships with consumers, which are not only beneficial for

business, but also for society and ecology (Park et. al., 2022) [16].

The company's production and logistics goals derive from general corporate goals, of which maximum consumer satisfaction is one of the most important (Metz et al., 2020) [12]. All other goals therefore derive from this fundamental goal. Accordingly, one of the key issues is to develop the concept of product performance, that is, to enable the maximization of value for the consumer. In terms of organizational management, this is possible through the application of a holistic approach where the marketing function will directly or indirectly coordinate with all functions, and ultimately with whole organizational processes. Therefore, it is important to understand the marketing function as the main mediator in the coordination and organization of most business processes within business systems (Bauer et al., 2004) [3]. In this context, the marketing function is an indirect agent that enables the overall quality of the process, and ultimately it manifests itself as the ultimate output in the form of superior products, i.e. satisfied consumers (Csikósová et al., 2018) [7].

Although, theoretically and declaratively, the role of marketing interfunctional coordination is not disputed at all, still a relatively large number of companies encounter difficulties in the form of interfunctional communication and coordination, primarily due to unclear or poorly defined dialogue between individual functions within the company, which in turn causes reduced efficiency. Such problems can be overcome through certain phases of research of the external marketing environment, strategic marketing planning, or during the operational application of certain marketing activities, but also during final reporting (Zhang et al., 2016) [23]. One of the solutions for such improvements can be the application of the paradigm of marketing transformation towards sustainability. It represents significant improvements, primarily in the domain of delivering greater value or benefits for consumers through efficient products (Sánchez-Fernández and Iniesta-Bonillo, 2009) [17]. In fact, the fundamental prerequisite for the delivery of effective products is the continuous development and application of innovative sustainable business experiences (Weinstein, 2020) [21]. Values and benefits delivered to consumers represent a kind of dedifferentiation strategy (Almquist et al., 2016) [1]. Therefore, the transformation of the marketing organization according to sustainable patterns in the context of achieving greater product performance is a strategy of competitive positioning and differentiation (Waljiyanto et al., 2022; Biloslovo et al., 2020) [20], [5]. This approach encourages the creation of longer-term and more stable relationships between consumers and organizations and is the assumption of their firm and permanent relationship (Zanchett and Paladini, 2019) [22].

Such a transformation should first of all be understood as a paradigm shift of the internal organizational management system (Cowan-Sahadath, 2009) [8].

In general, the transformation or change of an organization is the application of a more advanced, innovative or simply more efficient planning and planning system, with the purpose of adapting to processes in the external marketing environment (Errida and Lotfi, 2021) [9]. Organizational changes are largely caused by changes in organizational culture. Organizational culture represents an agile system represented by leadership (Ibidunni and Agboola, 2013) [10]. In the context of organizational culture, it is possible to understand the concept of market orientation, where according to Narver et al. (1998) in the process of creating and delivering superior value for consumers, the entire system is involved, which especially applies to all employees. As mentioned earlier, employees are encouraged to take this approach through the creation of an adequate organizational culture and market orientation. Furthermore, it is also recognized through specific focused planning, i.e., consequently through making focused business marketing decisions. Market-oriented companies regularly collect data about their consumers, competitors, and the market in general, thus

creating a picture of demand. In this sense, through a series of strategic operational actions, companies are enabled to create superior consumer value (Schulze et al., 2022; Noble Noble et al., 2002) [19], [15].

Knowledge about the effect of market orientation on product performance is important as an element for making strategic management decisions. positive effect on the product performance. Without the dynamic application of the concept of market orientation, it is not possible to assume desired product performance (Carbonell and Escudero, 2010) [6].

In this context, the purpose of this paper is to provide an insight into the influence of certain elements of sustainability included in marketing strategies of agricultural companies as the main prerequisite for achieving greater efficiency of their products.

## MATERIALS AND METHODS

The primary empirical quantitative research was conducted on a deliberate sample of experts representing business entities in the agricultural sector in the Republic of Croatia. The research unit is represented by a person, that is, an individual representative of an agricultural enterprise. Given that it is primarily a quantitative research, it was conducted using the survey method, and a survey questionnaire was used as a research instrument. Questionnaire variables (except sociodemographic questions) were constructed using a five-point Likert scale.

The target group of respondents consisted of a total of 200 respondents. A total of 147 correct answers were received, 53 answers were excluded from further research due to incomplete data. The questionnaire consisted of 38 questions, mostly closed-ended.

The empirical part of the paper was based on data collected through field research.

For data analysis, univariate analysis, and bivariate analysis (correlation analysis and regression analysis) were used. All collected data were processed and analyzed with the help of the statistical program package IBM SPSS 22.0, as well as MS Office Excel.

The assessment of the actual values of the model was checked on a sample of respondents, and reliability was determined for all variables from the model with the help of the Cronbach α coefficient.

## RESULTS AND DISCUSSIONS

### General research results

Respondents answered in the research by a simple procedure of rounding the selected among the offered answers, rating from 1-5, average values and exact amounts. The survey showed that the respondents were mostly men (56%), and there were a little less woman (44%). The average age of the respondents was 42 years, they had an average of 17 years of experience in agricultural production.

The research covered all Croatian regions, so it can be said that it is national research. The largest number of respondents is from the field of vegetable production, 37% of them, while livestock farmers made up 17% of respondents, fruit growers 13% of respondents, and cow breeders 26%. The rest of the sample is represented by beekeepers and honey makers with 4%, and growers of medicinal plants with 3%.

The largest number of respondents have completed some form of secondary school (61%), while those with completed college or university degree make up a slightly smaller number (35%), and a very small number of respondents have only completed primary school (3%). In the sample there were even respondents with the title of Doctor of Science (1%).

### Research results of strategic marketing transformation on product performance

For the purpose of researching the factors of marketing transformation on product performance, a study was conducted on the impact of certain elements of sustainability included in marketing strategies and market orientation on the effect of greater product performance. For the purposes of carrying out the research construct, two measurement scales were used that measured product performance as a dependent variable and marketing transformation as an independent variable, which includes elements of

sustainability included in marketing strategies and market orientation.

To measure the perception of product performance (PP) as a dependent variable, a measuring scale was constructed with the aim of evaluating the respondents' attitudes and opinions related to aspects of those internal and external attributes of the product that bring the greatest value and benefit to consumers.

The independent variable of marketing transformation (MT) is formulated with two dimensions: strategic marketing through the inclusion of elements of sustainability (SM) and market orientation (MO). For the independent variable of marketing transformation (MT), a particle reliability and multidimensionality check was performed. In order to be able to perform a factor analysis of 22 particles using the Varimax method with Kaiser's criteria, it was necessary to initially perform the KMO (0.721) and Bartlett's test ($\chi2$ = 2670.359, df = 148, p < 0.001). Factorization resulted in two factors, strategic marketing and market orientation. Both factors had a satisfactory level of reliability. After the factor analysis, a simple correlation and regression analysis was performed. (Table 1).

The results of the psychometric analysis of the measuring instrument indicate internal consistency, the Cronbach alpha coefficient is 0.881, and the total explained variance is 71.13%.

Table 1. Correlation matrix of the dependent variable PP and the independent variable MT

| | | **PP** | **TM** |
|---|---|---|---|
| PP | Pearson Correlation | 1 | 0.633 |
| | Sig. (2-tailed) | | 0.000 |
| | N | 147 | 147 |
| MT | Pearson Correlation | 0.633 | 1 |
| | Sig. (2-tailed) | 0.000 | |
| | N | 147 | 147 |

Source: author's calculations based on own research.

Therefore, the construct is reliable. The same procedure was carried out for the dependent variable of product product performance perceptions (PP).

Considering the positive Pearson's correlation coefficient, it can be concluded that there is a statistically significant connection between the variables from the construct (p < 0.001). The next step of analysis was regression analysis (Table 2).

Table 2. Evaluation of the representativeness of the regression model for the dependent variable PP

| **Pearson's correlation coefficient R** | **Coefficient of determination $R^2$** | **Corrected coefficient of determination** | **Estimated standard error** | **Change statistics** | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | R square change | F change | df1 | df2 | Sig. F change |
| 0.633 | 0.421 | 0.407 | 0.43715 | 0.421 | 87.102 | 3 | 144 | 0.000 |

Source: author's calculations based on own research.

Table 3. Regression model coefficients for the dependent variable PP

| **Model** | **Non standardized regression coefficients** | | **Standardized regression coefficients** | **t** | **Sig.** |
|---|---|---|---|---|---|
| | B | Standard error | B ponder | | |
| Constant | 3.567 | 0.447 | | 6.671 | 0.000 |
| PP | 0.079 | 0.153 | 0.324 | 0.636 | 0.000 |

Source: author's calculations based on own research .

The following table presents the regression model for the dependent variable, the effective product (Table 3).

The independent variable has a statistically significant influence on the dependent variable (p<0.001), where the standardized coefficient was 0.324. These two investigated variables had a coefficient of determination (R2) of 0.421. This concretely means that 42% of the variation of the product

performance is the result of variation in the marketing transformation. Therefore, the results of correlation and regression analysis show the existence of a statistically significant relation, and at the same time it can be considered that the marketing transformation has an impact on the development of effective products in the investigated companies, which was also confirmed by the relatively developed coefficient of determination.

## CONCLUSIONS

It is quite certain that the intermediary role of the marketing function is strongly present in the agricultural sector too. It is almost impossible to imagine modern and competitive agricultural production, i.e., the placement of its finished products on a saturated and highly aware market without the active mediation of the marketing instrument. The consumer has been at the centre of the marketing efforts of companies in all sectors and industries for a long time, which is why all efforts to research and serve him as best, faster, and more precisely as possible are clear. Marketing strategic orientation has a big contribution to all of this. Today, it is greatly influenced by contemporary trends both on the demand side, but the influence of the general environment is also important, which increasingly creates the general climate and trends that later result in consumer behaviour. Certainly, it should be emphasized that such changes are taking place due to the comprehensive acceptance and application of general patterns of sustainability. And for such goals to be possible, marketing organizations are under pressure to deliver increasingly valuable and high-quality products. Therefore, the logical transformation is in the direction of meeting the ever higher and more demanding criteria of consumers in terms of the delivery of values and benefits that are demanded today. These changes can be interpreted in the context of a change in the paradigm of an individual's life and through the prism of sustainable development, but also of economic crises that are becoming more frequent, longer lasting and more intense.

In this sense, marketing transformation represents a reaction on the supply side in the sense of adapting, developing, and offering efficient products that represent the delivery of benefits and value for consumers who are critical and expect marketing organizations to behave in the same way.

The results of the research confirmed the multidimensionality of the product performance and confirmed the psychometric characteristics of the measuring instrument for marketing transformation in such a context. The performed regression analysis shows the existence of predictive ability of appropriate elements of marketing transformation in the process of defining and offering efficient products performance on the market ($p < 0.001$), and the results of the research are in line with the general world trends because, empirically speaking, consumers are increasingly looking for and encountering products from which they demand greater performance in terms of the benefits and value they deliver. This fact must be an input to agri-food entrepreneurs in the context of defining effective and competitive marketing strategies as an opportunity for development and their economic prosperity, but also for general consumer satisfaction through the delivery of products of superior value and benefit.

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# STUDIES ON THE CORRELATION BETWEEN EXPLOITED AREAS ALONG CROP STRUCTURE AND THE MAIN ECONOMIC-FINANCIAL INDICATORS

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***Abstract***

*The present paper addresses a topical issue for the agricultural production sector and it is based on an economic-financial indicators analysis for a series of 17 main agricultural crops. The practical research was carried out with information and data for 10 agricultural holdings in Iași County. They operate in the vegetable production sector and have a solid commercial representation on the national market. The main indicators used in the study are: crops and shared areas for each of the 10 analyzed units, considering the relevance of crops for the national economy and economic-financial indicators relevant for the design of the production activity: turnover, profit, employes number. The reference year for which the research was carried out is 2021. The work methodology mainly uses quantitative methods and descriptive analysis, with the processing and interpretation of data that have been organized in a design configured according to the specifics of the paper. In addition, qualitative information collected through interviews is used. The results of the paper indicate the relevance of basic agricultural crops for the performance of large enterprises.*

***Key words*****:** *production, agriculture, profit, financial indicators analysis*

## INTRODUCTION

Domestic agricultural production is a pillar of general interest with relevance for the agricultural sector's contribution to economic growth [8]. Agricultural policies, national and European, support and contribute to the enhancements of the agricultural production systems. For these reasons, an analysis of the efficiency and profitability of agricultural economic units and different crop categories is necessary.

This paper proposes a quantitative analysis that uses data and information collected from agricultural production units, from the database of the Ministry of Finance [5] that indicates the most representative economic-financial indicators and from other sources of official reporting. The basic purpose of the work is to identify which are the most suitable crops from the point of view of profitability and, consequently, to proceed with the optimization of the exploited area within the agricultural holdings focused on primary production.

The economic units on which the study was carried out belong to the category of medium-large enterprises, both in terms of economic size and cultivated agricultural area.

The topic of the dimensioning of agricultural units is a specific one for Romania, given that small agricultural economic units (under 1 ha.) have been the majority for over 20 years, as a result of the fragmentation of agricultural production lands. This aspect reflected negatively on the level of competitiveness of the Romanian agricultural sector.

At the European level, especially through the update and reconsideration of the Common Agricultural Policy (2023-2027) [3], the issue of sizing agricultural production units has become of major interest, taking into account the latest requirements to promote the most sustainable production systems. Both at the national and European level, policies, strategies and work tools are adopted aimed at streamlining the activity of agricultural production units, to support their profitability and achieve market interests. The Common Agricultural Policy is the agricultural policy of the European Union which purpose is on

the one hand the sustainable growth of agricultural productivity in order to ensure food security for Union citizens and on the other hand to ensure a reasonable standard of living for agricultural producers and rural residents. (Robu et al, 2018) [9], [1].

The new Common Agricultural Policy (CAP) is dedicated to the goal of making "EU agriculture fairer, greener and more result-oriented" (EC, CAP 2023) [3]. The main aspect promoted in this matter at the European level and adopted at the national level is the approach of an agriculture based on performance. From January 2023 Member States must report their achievements every year, so that the monitoring of competitiveness and performance is more rigorous and specific. Through the new CAP 2023-2027, nine new specific objectives were launched. (National Strategic Plan 2021-2027) [4]. Among them, increasing competitiveness and increasing the degree of association are the subject of study of this paper.

The argumentation for the choice of this topic is given by the fact that national agriculture, although with an increasing performance capacity, still faces the problem of sizing agricultural units, an aspect that can decrease the expected level of performance both at the national level and at European level. Through the obtained results, it is demonstrated that large-scale agricultural holdings are productive and financially efficient and support the national economy by cultivating basic agricultural products, including for food security.

At the national level, in 2021, the turnover of agricultural enterprises increased by more than 30%, but this increase requires an analysis in correlation with other influencing factors, such as: the agricultural crops practiced, the profile of the market, agricultural productivity, etc. (Crăciun, D., 2022) [2].

The data reported by the National Institute of Statistics, following the 2020 Agricultural Census, indicate a favorable situation for the progress of national agriculture; at the beginning of 2021, 12.8 million ha of agricultural land was used in Romania. Although the number of agricultural units decreased by about 25%, the average area of a holding increased by about 28% (4.42 ha. in 2020 compared to 3.45 ha. in 2010) [7].

The decrease in the number of small holdings favors the increase in the average size of large holdings. This aspect brings advantages both for agricultural productivity and for the efficiency of the agricultural units. Farms with a used agricultural area of less than 1 ha decreased in 10 years (from 2010 to 2020) by 24.2%. From the point of view of ownership, 44.6% of the used agricultural area is owned by those who exploit it. (NIS, 2022) [6].

## MATERIALS AND METHODS

The methodological organization of this paper involved the construction and use of a database that includes 10 economic units from the agricultural production sector based in Iași County.

The reference year for the analysis is 2021. Justification for working with data for this year: although information on cultivated areas is available, with full reporting for 2022, reporting for the financial year 2022 is not yet available. Instead, for the year 2021, the economic-financial indicators are officially reported: turnover, net profit, number of employees.

For the analysis we used primary data in the form of the main economic indicators and primary data on the main crops and cultivated areas by each production unit. To these are added secondary data collected by interviewing entrepreneurs and representatives of the analyzed economic units.

In order to collect information and create the database, the most representative agricultural production units in Iași County were selected, based on their market position; data were collected from the Ministry of Finance and from the accounting reporting documents of the analyzed units. The protection of personal data determined the authors of the paper to use for the 10 economic units' attributes from 1 to 10 (U1-U10), without mentioning their names.

The necessary data were collected and selected as follows: from reference documents

regarding the cultivated areas and from financial-accounting documents regarding the values of the economic-financial indicators, the technical production capacities and the sizing of the main types of crops that were chosen. To these data fields, the authors added data taken from secondary sources of information, respectively from specialized literature and from reports of: Eurostat, the National Institute of Statistics, the Ministry of Agriculture and Rural Development. The collected data was organized for the purpose of processing and analysis, and later were interpreted to be able to achieve the objectives of the study.

The main economic-financial indicators were reorganized, grouped and processed considering the areas allocated to each of the available agricultural crops.

## RESULTS AND DISCUSSIONS

A preliminary overview of the 10 agricultural holdings indicates that they have exploited areas with a total size between 248.55 ha and 1,910.51 ha, the average exploited area of the 10 units being 617.6 ha. The analyzed units are part of the category of large agricultural units. By analyzing the Payments and Intervention Agency for Agriculture (PIAA) declarations with the exploited areas of the 10 agricultural holdings in 2021, it was possible to centralize the areas of all studied agricultural units.

A first important aspect noted through the organization and processing of the data is that all the analyzed agricultural units are oriented towards the most efficient use of the available agricultural land for the purpose of exploitation through basic crops. The 17 essential crops for agricultural production and other forms of optimal land use are: corn, wheat, sunflower, canola, soybean, seed lot, safflower, lucerne, forage plants, permanent grassland, temporary grassland, barley, oats, hay, triticale, sugar beet and peas.

Table 1 indicates the size areas of the 17 crops, expressed in ha, as well as the share in the total cumulative cultivated areas of the 10 agricultural units studied.

Table 1. Distribution of agricultural crops on total cultivated areas in the 10 analyzed farms - ha and %

| Crt.No. | Crop | Total - ha | Crop share % |
|---|---|---|---|
| 1 | Corn | 1,661.66 | 26.90 |
| 2 | Sunflower | 1,418.54 | 22.97 |
| 3 | Wheat | 1,054.83 | 17.08 |
| 4 | Rape | 611.51 | 9.90 |
| 5 | Lucerne | 348.40 | 5.64 |
| 6 | Seed lot | 231.04 | 3.74 |
| 7 | Sugar beet | 227.92 | 3.69 |
| 8 | Soybean | 167.64 | 2.71 |
| 9 | Permanent grasslands | 145.61 | 2.36 |
| 10 | Barley | 129.68 | 2.10 |
| 11 | Temporary grasslands | 37.32 | 0.60 |
| 12 | Oats | 33.16 | 0.54 |
| 13 | Green peas | 32.13 | 0.52 |
| 14 | Meadows | 31.45 | 0.51 |
| 15 | Triticale | 21.53 | 0.35 |
| 16 | Forage plants | 12.16 | 0.20 |
| 17 | Sainfoin | 11.45 | 0.19 |
| | **TOTAL** | **6,176.03** | **100.00** |

Source: Authors processing of primary data.

Table 1 indicates the share of the areas of the 17 agricultural crops practiced by the 10 analyzed farms.

We proceeded to present, first, the total areas, summed up for the 10 analyzed units and the ordering according to the size of the cultivated areas, with the aim of highlighting the priority crops for the selected agricultural producers in Iași County, respectively to later correlate this information with those of financial nature. Thus, from the total of 6,176.03 ha. owned by the 10 farms analyzed, corn and sunflower crops account for half of the total cultivated area (49.87%).

Given that these are basic crops for the agricultural economy of a country, it is noted that the analyzed farms contribute to the national agricultural sector improvement. Together with the 3rd crop, wheat, the total cultivated area is about 67%, i.e., almost 2/3 of the total area. Given that wheat is also a basic agricultural crop, the orientation of large producers towards these strategic agricultural crops can be confirmed. Maize, sunflower and wheat, basic agricultural raw materials for the food industry and the agri-food sector, are the most representative crops for the farms located in Iași County. In this context, we hypothesize that the profitability and economic efficiency of these crops are also high. At the opposite pole, the least representative crops are fodder plants and sainfoin with a total area of only 24 ha,

respectively less than 0.5% (0.39%) of the total cultivated area.

Another form of data organization led to the generation of Table 2, which highlights the presence of the 17 crops included in the analysis, in each of the analyzed economic units. Thus, it was followed to what extent each crop is present in each of the 10 agricultural holdings. This grouping allows the specialization on certain crops to be highlighted, which is another factor supporting productivity and profitability.

Table 2. Distribution of agricultural crops on the 10 farms analyzed (ha)

| Unit / crop | Maize | Sun-flower | Wheat | Rape seed | Lucerne | Seed lot |
|---|---|---|---|---|---|---|
| 1 | 163.82 | - | 53.89 | 111 | 20.92 | 3.64 |
| 2 | 40.78 | 55.79 | 135.88 | 45.06 | 12.50 | - |
| 3 | 74.99 | 325.96 | 43.29 | - | - | - |
| 4 | 44.50 | 43.73 | 84.07 | 31.70 | 20 | - |
| 5 | 130.66 | 92.76 | 119.93 | 135.99 | 69.75 | 227.4 |
| 6 | 123.59 | 30.91 | - | - | 6.68 | - |
| 7 | 48.43 | 75.97 | 41.15 | - | 106.9 | - |
| 8 | 27.18 | 81.09 | 54.46 | 42.08 | 13.94 | - |
| 9 | 415.37 | 374.06 | 210.86 | - | 4.21 | - |
| 10 | 592.34 | 338.27 | 306.80 | 245.68 | 96.49 | - |
| Total | 1,661.66 | 1,418.54 | 1,054.83 | 611.51 | 384.40 | 231.04 |

Source: Authors processing of primary data.

A data reorganization with cultivated areas indicates that the most important crops, traditionally for Romanian agriculture, wheat, maize, sunflower are cultivated by almost all 10 agricultural holdings: maize in all 10 holdings, and wheat, sunflower and lucerne in 9 out of 10 holdings. From the size area point of view, even if lucerne is cultivated in 9 agricultural units, the area is very small, so it does not have a significant weight in the total cultivated areas (384.40 ha. or 5.64%), an aspect that can be correlated with the slow dynamics of the zootechnical sector. Rape is in a similar situation: it is cultivated in 7 out of 10 holdings, but it has a limited share (611.51 ha or 9.9%).

For the other crops, the situation turns out to be quite different compared to the basic crops, which supports the hypothesis that the basic crops are profitable and accepted in the economic production activity of large-scale agricultural units.

Thus, sugar beet, soy, barley are cultivated in only 3 holdings on small areas (of 130-230 ha. or about 2.5% of the total cultivated area).

Table 2. Distribution of agricultural crops on the 10 farms analyzed (ha)- Continued (part 2)

| Unit/crop | Sugar beet | Soybean | Permanent grasslands | Barley | Oat | Temporary grasslands |
|---|---|---|---|---|---|---|
| 1 | - | - | - | 3.02 | 9.59 | - |
| 2 | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - |
| 4 | 20 | - | 0.52 | - | - | - |
| 5 | - | - | 101.6 | 80.02 | 23.57 | 37.32 |
| 6 | - | 21.74 | 6.33 | 46.64 | - | - |
| 7 | 41.58 | - | 1.14 | - | - | - |
| 8 | - | 22.13 | 4.70 | - | - | - |
| 9 | - | - | 31.32 | - | - | - |
| 10 | 166.34 | 123.77 | - | - | - | - |
| Total | 227.92 | 167.64 | 145.61 | 129.68 | 33.16 | 37.32 |

Source: Authors processing of primary data.

The permanent grasslands are owned by 6 agricultural holdings out of the 10, but on insignificant areas (of a maximum of 100 ha.) similarly to the situation of lucerne, considering the connection with the livestock sector.

Fo the crops in Table 2 (part 3) the situation is even more relevant in the sense of the absence of these crops (peas, meadow, triticale, forage plants, sainfoin) from most agricultural units. Only meadows are found in 3 holdings out of the 10 analyzed, but on a very small area (31.45 ha.). Peas, triticale and sainfoin are exploited in only 1 farm out of 10.

Table 2. Distribution of agricultural crops on the 10 farms analyzed (ha)- Continued (Part 3)

| Unit | Peas | Meadow | Triticale | Forage plants | Sainfoin |
|---|---|---|---|---|---|
| 1 | - | - | - | - | - |
| 2 | - | 3.47 | - | - | - |
| 3 | - | - | - | - | - |
| 4 | - | 4.03 | - | - | - |
| 5 | - | 23.95 | - | - | 11.45 |
| 6 | - | - | 21.53 | - | - |
| 7 | - | - | - | - | - |
| 8 | - | - | - | 3.47 | - |
| 9 | - | - | - | - | - |
| 10 | 32.1 | - | - | 8.69 | - |
| Total | 32.13 | 31.45 | 21.53 | 12.16 | 11.45 |

Source: Authors processing of primary data.

For a more suggestive representation of the agricultural crops related to the 10 farms, in 2021, we proceeded to a grouping by crop categories (Figure 1).

As can be seen from Figure 1, the most important areas are allocated to cereal crops, followed by oleaginous crops and seed lots. Arguments for the grouping of these categories of crops within the 10 agricultural holdings with a solid position on the market

are: the physical-geographical positioning in the Moldavian Plateau, the specific pedoclimatic conditions favorable to these crops, the advantages produced by the cultivation of seed lots, given that they have a very economic efficiency raised and supported by agricultural policies and strategies.

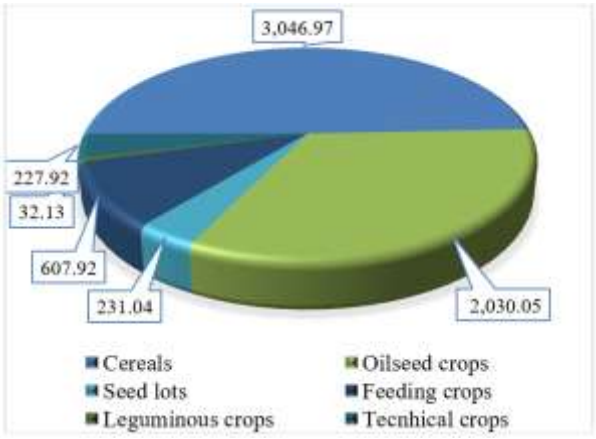


Fig. 1. Area share for every crop category of the 20 crops of all the 10 units - ha.
Source: Authors processing of primary data.

Thus, of the total exploited area of 6,176.03 ha., almost half (49%) are cereals, and 1/3 (33%) are oleaginous plants.
Current practices of sustainability assessments at farm level consider quantitative data and financial ratios [12]. Thus, another direction of analysis that has been carried out is the correlation of the exploited area with the number of employees, on the one hand, and the turnover of the unit with the profit, on the other hand.

Table 3. Analysis of the main size indicator (area exploited- ha) in correlation with a series of economic-financial indicators

| Unit number | Exploited area 2021 (ha) | Employees (number) | Turnover (lei) | Profit (lei) |
|---|---|---|---|---|
| 1 | 370.38 | 7 | 3,329,667 | 255,239 |
| 2 | 293.48 | 8 | 2,589,039 | 42,590 |
| 3 | 444.24 | 4 | 26,712,170 | 292,635 |
| 4 | 248.55 | 8 | 2,196,506 | 44,625 |
| 5 | 1,054.40 | 23 | 6,213,038 | 68,875 |
| 6 | 254.42 | 2 | 1,723,983 | 544,786 |
| 7 | 315.18 | 3 | 1,545,149 | 135,349 |
| 8 | 249.05 | 4 | 771,877 | 967,565 |
| 9 | 1,035.82 | 21 | 5,497,927 | 967,565 |
| 10 | 1,910.51 | 25 | 7,040,640 | 967,565 |
| **Total** | **6,176.03** | - | - | - |

Source: Authors processing of primary data.

Thus, we initially represented, in Table 3, the situation for each economic unit, starting from the exploited area and the main results expressed through the economic-financial indicators: the number of employees, the turnover and the profit. Even if such an approach is more relevant in the case of a much more complex analysis, over several calendar years, still even a situation for a single year (2021) can lead to relevant decision-making issues.
From the data presented in Table 4, it can be seen that the highest value of the profit per employee is registered within the units with a number of 2-4 employees. It can also be noted that the highest turnover per ha is recorded in the case of units with larger areas, of at least 400 ha. A very relevant piece of information for the proposed analysis is given by the correlation of turnover indicator with the number of employees indicator, economic indicators that are in a dependency relationship with the exploited area. Thus, it is found that the turnover increases in correlation with the cultivated area, respectively with the size of exploited ha. On the other hand, the estimated profitability is based on the whole system of measures related to capital investments, which are supposed to be carried out by proposed and specific deadlines [11].

Table 4. Correlation indicators between the exploited area, the number of employees and the turnover

| Unit number | Turnover per employee | Turnover per used ha - lei | Profit per employee – lei | Profit per exploited ha – lei |
|---|---|---|---|---|
| 1 | 475,667 | 8,990 | 36,463 | 689 |
| 2 | 323,630 | 8,822 | 5,324 | 145 |
| 3 | 6,678,043 | 60,130 | 73,159 | 659 |
| 4 | 274,563 | 8,837 | 5,578 | 180 |
| 5 | 270,132 | 5,892 | 2,995 | 65 |
| 6 | 861,992 | 6,776 | 272,393 | 2,141 |
| 7 | 515,050 | 4,902 | 45,116 | 429 |
| 8 | 192,969 | 3,099 | 241,891 | 3,885 |
| 9 | 261,806 | 5,308 | 46,075 | 934 |
| 10 | 281,626 | 3,685 | 38,703 | 506 |

Source: Authors processing of primary data.

A solution related to future decisions regarding ensuring the continuity of profitability is the expanding the exploited land areas by increasing, where possible the areas.

However, even if this is a technically-economically viable solution, socially and legally, the entrepreneurs of these holdings face a set of barriers, such as:
- the deficient mentality for progress, given the reluctance of the rural population, which are the owners of uncultivated or abandoned agricultural land, to sell the respective land;
- the aging population that refuses to sell, citing the aspect of the sentimental value of the land, or they consider keeping the land as a legacy for the next generations; other owners do not understand the economic value of the land;
- the bureaucracy, the rather high costs involved in a land sale process and the difficulty of the property transfer act represent other significant obstacles;
- from the legal point of view, in the context of a lack of any rigorous organization of the cadastral and agricultural land records, many owners do not have the updated documents of the land in the property or there are errors in the registration of these lands, especially due to notarial fault;
- other owners, out of convenience or lack of knowledge, do not proceed to land inheritances, so a desired sale, with the firm promise of obtaining a favorable price, is blocked or slowed down by the difficult updating of ownership documents; in this situation, conflicts also arise in the extended family, an aspect that can completely prevent the deed of sale.

Consequently, even if the entrepreneurs owning the holdings on which the present study was focused would be interested, economically and technically, in acquiring the advantages as a result of land purchases, they are forced to limit themselves to a surrogate activity, that of leasing of the lands. Thus, the goal of expanding the exploited areas and further increasing the productivity and profitability of large-scale agricultural enterprises can be achieved.

Proven a viable solution, in the short or even medium term, leasing also proves to be hampered by some aspects mentioned by the entrepreneurs interviewed in the field.

These difficulties boil down to:
- competition between agricultural companies that lease land, which makes the rates for leasing services increasingly high; under the conditions of considering the mode of operation of the competitive economy, this is an indication of the profitability of this field of interest - the cultivation of agricultural land with economically valuable plants and crops;
- under the conditions in which entrepreneurs invest in technology, in infrastructure, in improving the quality of land, etc., the value of these lands increases by default, an aspect speculated by the owners who either decide to sell it to other categories of investors, or put pressure in the form of conditioning by increasing the value of the lease, in the form of money or in the form of agricultural products; In addition, very few of the landlords who lease the land honestly express their satisfaction with the benefits obtained, most citing the "losses" they register as a result of the lease. A possible solution to compensate at least partially for these situations encountered in this sector would be creation of groups of producers or cooperatives in this sector can probably be one of the best solutions to increase the profitability of these farms, especially among subsistence and small or medium-sized ones [10].

## CONCLUSIONS

Through this paper, it was possible to identify and highlight the connection between the direction of effective agricultural production support policies and the actual results of the economic activity and production in the reference agricultural holdings. In this way, the multifaceted analysis of the main economic efficiency indicators for the 10 agricultural units was carried out. The quantitative analysis, of descriptive order and data interpretation was conducted to support the aim of the paper. An addition was realized, with a secondary form of analysis, of qualitative order, based on the information gathered as a result of interviewing the representatives of the 10 agricultural units included in the study. The main synthetic results are concentrated as is follows:

- the ten agricultural units on which the analysis was carried out cultivate a total number of 17 crops, on a total area of over 6,000 ha.;
- a permanent concern of the units management is to expand the exploited areas, either by purchasing land or by leasing;
- the purchase of land has an insignificant contribution to the expansion of the exploited surfaces;
- the main way of expansion is taking over the lease, but even in this situation the agricultural units face certain problems;
- the seed lots opportunity emergence in recent years leads to a rise of the lease value perceived;
- the development of modern technology and investments in agricultural equipment supported, by the national and European financing programs is a major advantage for agricultural producers;
- starting from the number of employees correlated with the exploited area, it was found that the profit per employee is maximum, within the 10 units studied, at the units that have 2-4 employees;
- the decision-makers within the farms interviewed have the permanent goal of expanding the exploited surface, by purchasing land or leasing it from the owners.

Finally, it is proven that a complete analysis of efficiency and competitiveness for an enterprise, is adequately measured in order to make the best decisions for planning the next production, by correlating the technical indicators with the economic and financial ones. The large enterprises have demonstrated, after long waits in our country, their strategic role for economics and the market power, compared to subsistence farms. Investments, financing programs, the support offered by agricultural policies and the selflessness of large producers turned out to be the successful elements for supporting a solid agriculture, producing agricultural crops necessary to ensure food security and economic power.

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# LAND CONSOLIDATION IN TURKEY - A MULTIPURPOSE/DISCIPLINE LAND CONSOLIDATION IN TURKEY WITH ICT SUPPORT 2023

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***Abstract***

*The goal of the study is to reorganize agricultural business management's owning small, fragmented, and dispersed lands according to modern agricultural business management thus ensures less usage of time, labour force and fund, take advantages of production factors and increase in productivity of agricultural business managements, increase agricultural production, and ameliorate life standards of inhabitants in the rural area. The paper is based on a large literature in the field and information from TVK about land consolidation. The results reflected that Turkey has implemented Land Consolidation activities for 1 million hectares per year to correct the unfavorable situation caused by inheritance traditions and other reasons. In the first years of the program, inheritance regulations were not perfectly organized, so applications encountered issues. In 2014, new regulations were implemented to prevent land division but did not have a beneficial effect on the development of enterprises. To ensure compensation for land value when they move away, Land Banking applications are needed. The Ministry of Food, Agriculture and Livestock developed a GIS based web portal named "TVK" to track and monitor all the activities performed during the management of Land Consolidation Projects. TVK ensures following content to be executed: Contract Management, Project Management and Monitoring, Schedule Planning and Monitoring, Operation Management and Monitoring, Data Management (Textual and Geographical), Estimated Cost Calculation for a LCP by using unit price pool, Progress Payment Management and Monitoring, Final Account Calculation, Interim and Final Acceptance Procedures, Official Letters, Official Reports, Project Statistics, Geographical Data Marking, Correction, Comparison, Redlining, Mobile applications and E-government integration.TVK has instant and online access to governments Land Registry and Cadastre Information System, Central Population Information System, Address Registration System, Agricultural Information System and Agricultural Parcel Information System. TVK is developed with open-source technologies and compatible with OGC (Open Geospatial Consortium) and ISO standards.*

***Key words*****:** *land consolidation, multipurpose, discipline, TVK, Turkey*

## INTRODUCTION

This research study tries to consolidate fragmented lands which are the most important problem of Turkish agriculture.

When the land becomes smaller income obtained from agricultural activities decreases and input expenses decreases when the land becomes larger.

Hence Land Consolidation is indispensable for Turkish Agriculture.

Land Consolidation can be expressed as the process of combining, shaping and reorganization of the fragmented, disintegrated, bad shaped -for various reasons- parcels for which economically impossible to perform agricultural activities, following the basis of modern agriculture business management and most appropriately performing irrigation [10].

Land consolidation works first started in 1961 in Turkey. Studies were carried out by various general directorates affiliated to the Ministry of Agriculture.

Finally, with the amendment made on 2.7.2018 in the Law No. 6200 on the "Organization and Duties of the General Directorate of State Hydraulic Works", the authority to implement land consolidation was

given to the General Directorate of State Hydraulic Works (DSI).

In the Additional Article 9 of the Law, the purposes of land consolidation practices are given as follows [6]: "Preventing the deterioration and fragmentation of lands by natural and artificial effects, in fragmented lands, combining more than one land plot by considering their natural characteristics, usage integrity and property rights, creating new parcels that are more functional in terms of economic, ecological and social aspects, and determining the usage patterns of these parcels by evaluating the land characteristics and area. Land consolidation is carried out with the aim of providing village and land development services."

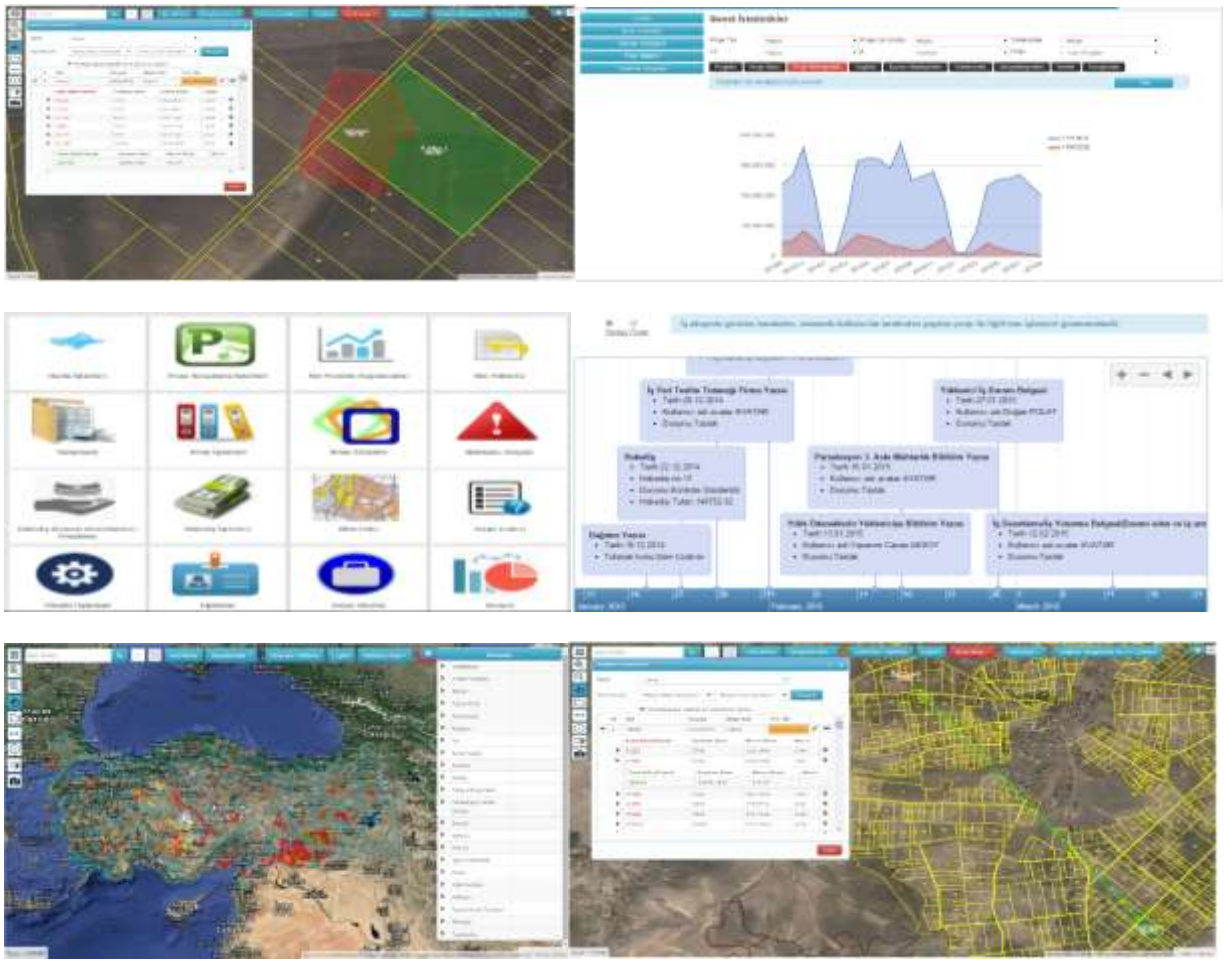

Fig. 1. Snaphots from TVK Land Consolidation ICT Tool
Source: Turkish Land Consolidation Database (TVK), 2020 [11].

Land consolidation studies carried out to date.
Total Planned Potential Area : 14.3 million Hectares.
Completed and ongoing: 8.2 million hectares
Not started: 6.1 million hectares
Total: 14.3 million hectares
Details of Started.
Registration completed to date: 3.95 million hectares.
Under registration process: 2.55 million hectares
Finished and at the registration phase: 6.5 million hectares.
Ongoing area: 1.7 million hectares
Total: 8.2 million hectares

In this context, the objective of the study is to reorganize agricultural business management's owning small, fragmented, and dispersed lands according to modern agricultural business management thus ensures less usage of time, labour force and fund, take advantages of production factors and increase in productivity of agricultural business

managements, increase agricultural production and ameliorate life standards of inhabitants in the rural area.

## MATERIALS AND METHODS

The research work is based on a large range of information sources regarding the legal background and data from TVK- Turkish Land Consolidation Database, 2020 [11].
The information was logically structured and emphasized the main important results regarding land consolidation in Turkey.
The data were illustrated in suggestive graphics regarding the following indicators: Number of land consolidation projects, Number of consolidated villages, Number of parcels before and after consolidation, amount of landowners before and after consolidation for each year in the period 2010-2014.

## RESULTS AND DISCUSSIONS

### Land problems in Turkey agriculture

By Turkey's inheritance legislation, shares of agricultural land subject to inheritance are fragmented. Sometimes 400 shareholders can occupy only 1 parcel. The average parcel size is around 0.7 hectares, which does not meet the requirements of modern agricultural techniques. In this situation, agriculture is not sustainable in Turkey. Agricultural lands are registered for 40 million individuals while only 3 million is farming [2, 6]. About 37 million people living in the cities cannot use their shares in the parcels in the village. If a person owns a 200-300 $m^2$ share of a 0.7-hectare land, this person cannot use, rent or sell this area. Because this area is not a size that can be separated from the main parcel and used independently. In this case, this parcel is used by a shareholder living in the village, without the consent of the shareholders, without any legal agreement. This situation negatively affects 3 million farmer families engaged in farming. Because these people are not the owners of the land they use. Although they own some shares in the parcel they use, most of the parcel belongs to other relatives. For this reason, people who farm in the village and actually use these parcels cannot invest because they do not own all the parcels. They cannot take advantage of credit or subsidy for the land and cannot carry out a project or make an investment.
On the other hand, 37 million landowners, generally living in the city, who have shares in these parcels, cannot use, sell, or rent their land. Therefore, this group is also adversely affected by this situation.
In addition, most of the existing parcels cannot legally benefit from the existing irrigation and road network. Most of the existing parcels do not have a suitable geometry in terms of agricultural mechanization. In Turkey due to inheritance and other factors, agricultural business managements holding lands decreases day by day. In 1950 there was 2.2 million business management and average business management size was 10hectare but in 2000 despite business management increased to 3.02 million, average business management size is decreased to 6.1 hectare (Table 1). [10, 7] When business management scale decreases number of fractions increases. Today there is an average of 7 fraction of land per business management.
Cultivable agricultural land area is 23 million hectare however economically irrigable land area is 8.5 million hectares in Turkey [5, 12].
According to studies performed using satellite data and latest calculation technologies in Turkey land that can be consolidated is calculated as 14-million-hectare area, constituted by 8.5 million hectares irrigated and 5.5-million-hectare dryland [8].
In irrigation network, the one of the most important causes of lowness of the irrigation rates and irrigation efficiency is irrigation projects are constructed without considering land consolidation and internal farm development services.
Today, average there are 600 - 1,000 parcels, 1,500 - 2,000 owners (people who own the land), 6,000 - 8,000 shares in a village in Turkey. On the other hand, the number of families engaged in farming in the village is around 15-20. In short, parcels are very shareable. Most of the owners of the lands in the villages live in the cities.

Two different groups emerge here.
The first of these is those who own land but cannot use their land and live outside the village.
When consolidation comes to a village, the owners in this group generally want their lands to be separated from other shareholders and become an independent parcel to save their unused lands from their relatives.
It is not possible to implement these requests. Because if these demands are fulfilled, hundreds of small new parcels will be created in that village.
The second group is the group that cultivates the land.
15-20 farmer families who cultivate the land are also victims. Because this group that cultivates the land knows that not all the lands, they cultivate are theirs, and therefore cannot invest in their land, cannot get loans because they cannot mortgage the land, and therefore cannot use the land properly or make investments.
On the other hand, this group also wants the parcels to remain as they are, without the shares being separated. Because if the shareholder who does not use the land allocates their own shares and becomes an independent parcel, then they can rent orsell these parcels to others.
Therefore, land consolidation is blocked in Turkey today. This dilemma needs to be eliminated as soon as possible. In practice, all parcels are left in place and consolidation cannot be applied. For this reason, there are objections to too much aggregation. Due to these objections, consolidation practices are currently being criticized a lot. Objections cannot be resolved.
In previous years, since the parcels were in the name of the next lineage, there was no such fragmentation and consolidation practices could be done much more successfully.
Especially since agricultural supports were not given to the parcels that were not transferred, the transfers accelerated in Turkey and the multi-shareness and fragmentation accelerated accordingly.
This situation began to hinder the success of land consolidation. It started to show itself after 2008, when land consolidation under the existing structure was not successful. However, this negativity could not be avoided as there is no legal basis for the land banking system or similar applications. In 2014, the inheritance law was revised, and the legal base of the land banking system was created.
Today, the fact that land banking applications are not carried out together with land consolidation applications reduces the success of the applications and increases the objections.
Observations made in the field necessitate that land consolidation studies be carried out together with land banking practices in order to increase the effectiveness of land consolidation projects. However, land banking applications are not yet widely implemented.
TVK Land Consolidation Data Per Year is presented below as follows: Number of land consolidation projects (Figure 2); Number of consolidated villages (Figure 3); Count of parcels before and after consolidation (Figure 4);Number of owners before and after consolidation ( Figure 5).

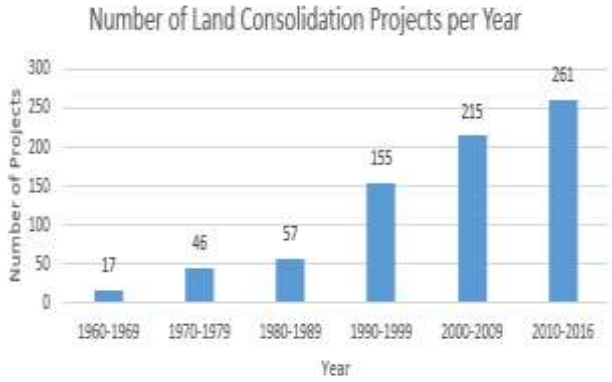


Fig. 2. Number of land consolidation projects/year
Source: TVK, 2020 [11].

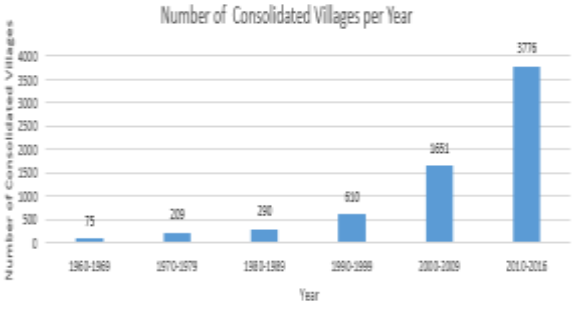


Fig. 3. Number of consolidated villages/year
Source: TVK, 2020 [11].


Fig. 4. Number of parcels before and after consolidation/year
Source: TVK, 2020 [11].

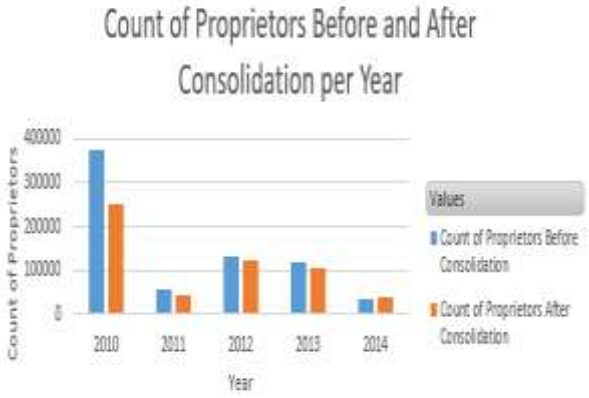


Fig. 5. Number of land owners before and after consolidation/year
Source: TVK, 2020 [11].

**Works related to creating the corporate structure of land banking and attracting lands to production**

The establishment and development of an institutional structure is of great importance to effectively carry out activities such as solving the property problems that cannot be solved by land consolidation, enlarging the scale of the enterprise, arranging land purchase-sale services, preventing land speculation, developing production models such as tenancy and sharecropping, and bringing idle lands into production is important. Such an institutional structure is needed more than ever for a strong agricultural sector [5].

The term land banking is widely used in developed countries. Although the term land banking in our country can be perceived as a commercial bank in which monetary transactions are carried out, it actually refers to the institutional structure in which land acquisition works and transactions such as the development, purchase-sale, rental of agricultural lands, determination of land prices and rental prices are carried out.

**Legislation on land banking**

In order to solve structural problems in agriculture in Turkey, land banking was discussed for the first time in the 2004 "Agricultural Council" and the most important tasks of land banking, "Acceleration of consolidation works" and "Optimizing business scales" were explained as the council decision [4].

The legislation of Land Banking is constituted by Article 8/A-K of the Law No. 5403 on Soil Conservation and Land Use. According to the express provision of the law; "Ministry; takes necessary measures to increase the size of agricultural land with sufficient income. Moreover, Determination of the value of agricultural lands, obtaining loans, arranging sharecropping, splitting, tenancy works, determining rental prices and directing them to production, creating supply and demand lists, acting as direct intermediary in the agreements of buyers, sellers and tenants, cooperating with relevant public administrations on policies to be carried out in this field. It carries out or has it done, such as providing technical support for credit transactions. » is called.

The need to produce more for the increasing demands of the increasing population and industry in our country in recent years has prompted the governments to determine the agricultural lands that have been idle for various reasons and to bring them into production, and it has been among the important issues of government programs [3]. In this context:

• In the Average Term Program (MTP) published in the Official Gazette dated 27.09.2017 and covering the 2018-2020 period, "Idle agricultural lands will be brought into production with models such as land banking." expression,

• Measure 280 published in the Official Gazette dated 28.10.2017: "Models will be developed for bringing the idle agricultural lands into production and for the efficient

operation of agricultural enterprises." expression,

• In the "New Economic Program (Balancement-Discipline-Change) 2019-2021 MTP, which was published in the Official Gazette dated September 20, 2018 (Presidential Decision No. 108), the necessary institutional and legal infrastructure will be established to bring the idle agricultural lands into agricultural production." and,

• Measure 309 included in the "2019 Presidential Annual Program" in the Official Gazette dated 27.10.2018 (Presidential Decision No 256) states, "Land acquisition practices for bringing idle agricultural lands into production and efficient operation of agricultural enterprises and accordingly Land Banking will be developed." Statements are included.

The "Regulation on Land Acquisition Business and Transactions", which is planned to be implemented in the execution of land acquisition works and transactions, was published in the Official Gazette dated 13 April 2018 and entered into force.

The purpose of the regulation is to ensure that the works and transactions related to the agricultural lands subject to the acquisition of agricultural land are carried out in an orderly manner. In the regulation, the procedures and principles regarding the lands subject to land acquisition in consolidation project areas and other areas have been determined. For this purpose;

1. Identifying (idle) agricultural lands that are not processed and not used in agricultural production due to reasons such as shareholding, fragmentation, property conflict, termination of agricultural activities and migration, and directing them to production in the form of leasing, sharecropping or half-farming,
2. Gathering the necessary information and documents about the lands subject to sale, creating the lists, matching the buyers and sellers, posting the lists on the Ministry's corporate website and on site, and appraising the land prices upon request,
3. Creating lists of the parties related to the lands subject to lease, matching the lists, determining the rental prices upon request,
4. Implementation of transactions in order of priority, if any,
5. Evaluation of possible complaints and objections,
6. Providing technical support by the Ministry in the loan transactions of those who want to use loans other than equity in land acquisition,
7. The works and procedures related to making a request to the Ministry of Finance and carrying out the necessary procedures for the expropriation of agricultural lands that cannot be shared, whose transfer transactions cannot be resolved, and which are not approved for sale and lease, in order to be evaluated in accordance with the Law and production purposes, have been determined [1].

However, the fact that the law no. 5403 is based on voluntariness in land acquisition works and transactions, and the absence of sanctions and incentives has led to the failure to achieve the expected developments in land banking practices. More importantly, the fact that the Ministry could not take a decision on filing a lawsuit in the solution of property problems caused the implementations not to be started. However, in the purchase, sale and lease of agricultural lands, the Ministry has been given very important duties such as intermediary and directing.

Despite everything, no application has been made regarding land acquisition (land banking) until today. Since there is no application, we do not have detailed information about the application.

**Efficient solutions**

There are two methods to prevent fertile soil loss due to land fragmentation. First method is Land Consolidation Legislatives [10, 8] for the current fragmented lands to be consolidated. The second one is Inheritance Legislations [3] to prevent future potential fragmentations.

The first one encounters agricultural land selling processes as well. We first constructed our legal basis and then started to implement it with a deterministic approach.

Table 1. Count of business management versus average cultivable area

| Year | COUNTOUNT OF BUSİNESS MANAGEMENT (MİLLİON) | Average Cultivable Area (decare) |
|---|---|---|
| 1950 | 2.2 | 100 |
| 2000 | 3.02 | 61 |

Source: Turkish Land Consolidation Database (TVK), 2020.

To manage, track and monitor land consolidation activities, Turkey created its own land consolidation database and a GIS based ICT Tool named TVK (Fig. 1) has been developed.

By means of this tool, Land Consolidation projects of the whole country is managed centrally, and GIS data topology is controlled prior to be stored in the database. TVK ensures management of the following features; Contract Management, Project Management and Monitoring, Schedule Planning and Monitoring, Operation Management and Monitoring, Data Management (Textual and Geographical), Estimated Cost Calculation for a Land Consolidation Project by using unit price pool, Progress Payment Management and Monitoring, Final Account Calculation, Interim and Final Acceptance Procedures, Official Letters, Official Reports, Project Statistics, Mapping, Geographical Data Marking, Correction, Comparison, Redlining, Mobile applications, E-government integration. TVK has instant and online access to governments Land Registry and Cadastre Information System, Central Population Information System, Address Registration System, Agricultural Information System and Agricultural Parcel Information System. It is developed with open-source technologies and compatible with OGC (Open Geospatial Consortium) and ISO standards [10]. If anyone has more than one land within the frontier of a single village, they are ensured to be consolidated in one piece as much as possible. We have to go to the business management, make research about the village, explore village parcel structure, their ownership. In the scope of land consolidation, one should determine the problems that can be resolved for this village. Besides we ask for a report including internal farm development studies as village canalisation status, inner village roads status, parcel size and share distribution, parcel road status, drainage, contour, stone picking, land improvement. All these studies are managed and tracked by TVK-GIS based ICT tool that we have developed [9]. By means of Land Consolidation Legislatives one should obtain less shared and less fragmented land parcels. Thus, investors can easily buy one single piece of land from one seller (Fig. 2).

By means of Inheritance Legislations family business managements will be founded. Some of the inheritors can buy the other inheritors shares and cultivate all of the land by themselves or an investor will agree with inheritors and buy all the shares or government will release it for other investors to buy, else when there is a discordance with inheritors government will make an expropriation and buy the land to sell it for the investors who will make cultivation. Inheritance Legislations prevents the land to be fragmented, from a certain amount of people a business management is obligatory and instead of sharing the land area, the company's shares will be distributed among inheritors. Laws prevents selling of the parcels by fragmentation. When the land yield is less than business management's enough income these parcels cannot be fragmented nor sold. We are currently working on a new ICT tool that will manage inheritance processes. This tool will track land sales and inheritance applications. That will consolidate dispersed lands and meet with investors. This process of legally and physically regulated agricultural lands matching with investors is called Land Banking. In this way if there is a good investor who will seriously make cultivation, transfer by inheritance process immediately turns into a selling process.

## CONCLUSIONS

Land Consolidation activities comprises significant benefits with regards to farmers as well as public investments.

Current fragmented parcels are consolidated, and the potential fragmentation are prevented in Turkey by land consolidation and inheritance legislatives.

In Turkey, legislative regulations and ICT solutions applied for Land Consolidation has become effective and land will be strictly protected, therefore implemented methods can be carried onto international platform to protect the soils in the world toward corrective actions and improving opportunities in global scale.

## ACKNOWLEDGEMENTS

We dedicate this article to our colleague Doç. Dr. Gürsel KÜSEK, who lost his life in a traffic accident, as we write this article.

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# ENVIRONMENTAL AWARENESS OF STUDENTS OF NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES (NULES) OF UKRAINE IN THE CONTEXT OF MODERN CHALLENGES

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***Abstract***

*This paper aims to provide evaluation of environmental awareness of students of the National University of Life and Environmental Sciences of Ukraine (NULES of Ukraine) taking into account challenges that appear due to the war. The problem of the research is reduced to answers to the following questions: (1) What sources of information do students use in order to be aware of environmental problems? (2) Do the war in Ukraine influenced on the youth awareness increase about the environment problems? (3) What priority measures should be implemented to solve environmental problems in wartime conditions? To realize purposes in the article, sample observation within students of Economic faculty was done. Results showed that 94.1% of respondents are worried about environmental problems. At the same time main sources of information about environment issues were social networks (44.1%); internet sources (41.2%); television (11.8%) and press (2.9%). Besides, 20.6% of students assumed that information about environment is easily accessible, 52.9% accessible, and 26.5% difficult accessible. Most of the respondents considered that the environment theme is not popular enough in the mass media (79.4%). Russia invasion has provoked sharpening environmental problems, where results of the survey showed that 88.2% of respondent's deep environmental awareness. In addition, 44.1% of surveyed students worry about the environmental consequences of the war. To find answer to the question about measures that should be implemented to solve environmental problems in present conditions, the SWOT analysis was done, where in the opportunity square are indicated main points, which should be realize: the rules of conduct and norms of responsibility for environmental offenses should be improved at the state level; the creation of appropriate infrastructure for the population to fulfil its environmental responsibilities; highlight environmental issues in the mass media and social networks; growth the role of non-governmental nature protection organizations and universities in raising the public's awareness of environmental problems; development, adoption and implementation of the national program of environmental education in educational institutions.*

***Key words*****:** *environmental awareness, ecology, students, NULES of Ukraine, information, sample, survey, SWOT analysis*

## INTRODUCTION

Ecological awareness is a complex concept. In a broad sense the concept of „ecological awareness" is a new form of social awareness that manifests itself in the thinking and experiences of individual people and functioning of standards of living, evaluation and understanding of elements regarding the biosphere [5].

Possessing knowledge about the environment is an important aspect in the context of the formation of environmental consciousness. In the view of modern environmental problems, the dissemination of ecological knowledge becomes one of the most important tasks of both individual families and educational institutions.

The ecological awareness and behaviour of each person is largely formed under the influence of the social environment in which the person lives. Different segments of a country's population may have different motivations and goals regarding environmental issues, even when they are in the same environment conditions.

At the same time, it is worth highlighting the factors that restrain or promote environmental behaviour of a person [3].

Factors of environmental behaviour can be divided into the following groups: (1) external, arising from environmental conditions; (2) internal, characterizing the physical and psychological characteristics of a person.

External factors of human environmental behaviour include social, cultural, economic, legal and other components. The conditions of the listed factors are constantly changing, and their interaction with each other is also observed.

As practice shows, force majeure circumstances that arise in the external environment (for instance, war, ecological accidents or cataclysms) significantly affect the perception of the importance of ecology.

The internal factors of environmental behaviour depend on a person's psychological characteristics, motivation and values in relation to the environment.

The questions regarding the study of the environmental awareness of the population and especially young people are being studied by scientists from many countries.

Balińska et al (2020) studied the issue of environmental awareness among young people. Indeed, the authors of the study checked the sources of information used by students of the Faculty of Economics of the WULS-SGGW (Poland) in the formation of their environmental awareness. They came to the conclusion that the main source for students is social networks and internet portals. At the same time, they noted that issues of environmental protection are not covered too much in the mass media [1].

Kociszewska (2014) in her research indicated that ecological awareness requires breaking the existing scheme of thinking, changing the criteria of values, which in turns requires constitutes a significant change in people's relation towards environment. She resumed that developing ecological awareness and the active attitude of care regarding nature should start from early child's life [5].

Wierzbiński et al (2021) defined the role of ecological awareness and influence on the food purchasing habits of young consumers in shaping their pro-ecological attitudes. They obtained results that young consumers reject the offer of cheap mass food and are ready to pay up to 50% more regarding guaranteed access to high-quality food products [13].

Many scientific research concern to evaluation of indices that measure the environmental pollution and its influence on economy, especially agriculture.

Dong and Wang (2023) in their paper were scrutinized the affect of air pollution on the global agriculture using the indicator of total factor productivity (TFP). Indeed, there are convinced that air pollution has been a significant threat to the enhancement of global agricultural TFP [2].

Li et al (2019) evaluated the linkage between agricultural economy and agricultural pollution using the method of decoupling index that helped to explore the key factors affecting the decoupling effect and to identify the direct relationships between mentioned factors [8].

Unforeseen environmental consequences due intensive agricultural practices and inputs use studied by Killebrew and Wolff (2010). They came to conclusions that agricultural intensification facilitates farmers to get greater yields per unit time and area by planting more crops each year, specialized on growing monoculture and using higher amounts of external inputs. Herewith defining the appropriate balance of costs and benefits from intensive agricultural practices is refer to the local territory, where should be known evaluation of natural, economic, and social conditions [4].

Mateo-Sagasta et al (2017) in their study justified that the growth of crop production worldwide has been achieved mainly through the intensive use of inputs such as pesticides and chemical fertilizers. The tendency was strengthened expansion of agricultural land where irrigation plays a strategic role in improvement productivity and livelihoods in rural areas, and by transferring agricultural pollution to reservoir. At the same time the livestock sector is growing very fast and associated waste has negative consequences for water quality [9].

Key ways of agricultural influence on environment was researched by Ritchie et al (2022), i.e. (1) water needs for agriculture, which can cause significant environmental pressures in regions with water shortage; (2) greenhouse gas emissions and as a result climate change; (3) large amount of land use worldwide [11].

Environmental science and technology help in improving the natural environments that give healthy life to human beings by providing better quality of water, air, and land and also keeping the area pollution-free. Besides, nowadays consumers and companies are looking for alternatives to mitigate pressure on environment resulting from continuous population and economic growth [10].

Nowadays, the topic of environmental awareness of youth in Ukraine has become extremely important. The hostilities caused by Russia led to many negative consequences, including environmental problems.

In these conditions Ukrainian young people aware these threats and ecological awareness could increase in the future.

Thus, our research is important and relevant, as it involves highlighting the level of environmental awareness of students of NULES of Ukraine and emphasize priorities in solving environmental problems.

The paper is organized as follows: Section 2 described the data and methods of empirical investigation; Section 3 reports getting results; and Section 4 ends with conclusions of getting results.

## MATERIALS AND METHODS

The purpose of the article is to evaluate environment awareness by students of the Economic faculty of National University of Life and Environmental Sciences of Ukraine due to analysing information that was assembled from survey.

In the paper the following questions were given, i.e.: (1) What sources of information do students use in order to be aware of environmental problems? (2) Do the hostilities in Ukraine influenced on the youth awareness increase about the environment problems? (3) What priority measures should be implemented to solve environmental problems at present?

Statistical survey method was used as the methodical approach of the research that includes target group of participants' observation and the survey technique.

The target group of observation consists students from different specialties of the faculty and different study years, i.e. Economics; Accounting and Taxation; Finance, Banking and Insurance; Entrepreneurship, Trade and Exchange Activities. The age of students varies from 18 to 22 years.

The questionnaire was prepared on the google platform. The link to created questionnaire was sent to students of the Economic faculty of NULES of Ukraine.

The questionnaire was held in the distance form, where the respondents filled it in and sent back to us.

The questions of the survey were in the different form, i.e. closed-ended, open-ended and yes and no questions.

Questions that were included in the questionnaire were related to their attitudes to the environment.

The questionnaire research was conducted in 2022, where 94 correctly filled in questionnaires were chosen for further research.

To generalize the environmental awareness of the population in Ukraine and to define main directions of increasing youth environmental awareness SWOT analysis was used.

## RESULTS AND DISCUSSIONS

National University of Life and Environmental Sciences of Ukraine is one key university of natural science.

Taking into account this fact, we were conducted our survey research at the Economic faculty of NULES of Ukraine for students of bachelor's degree from different specialties to get information regarding youth attitudes to the environment (Fig.1).

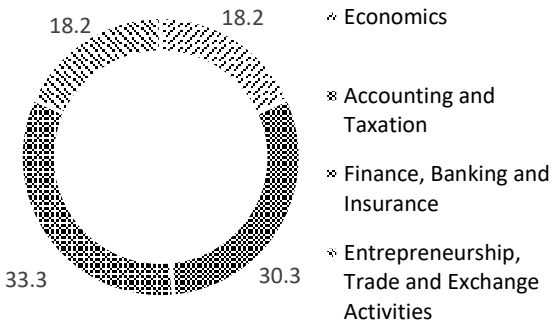


Fig.1. The structure of the distribution of respondents according to the specialty of study
Source: author's research.

As we can see from the Fig.1, 30.3% were respondents from the specialty of Accounting and Taxation, 33.3% Finance, Banking and Insurance, 18.2% Entrepreneurship, Trade and Exchange Activities, and 18.2% Economics.

The majority of the respondents were women, i.e. 85.3% of the sample. Students grew up in different settlements, including 35.3% in villages, 32.4% in cities, 23.5% in small towns, and 8.8% in Kyiv.

Despite certain differences among survey participants, the vast majority (94.1%) are concerned about environmental issues (Fig. 2).

Similar trend was noted in the research of Sousa S.et al (2021). Results indicate that most students of a public higher education institution in Portugal are aware of the importance of protecting the environment and consider themselves well informed about environmental issues [12].

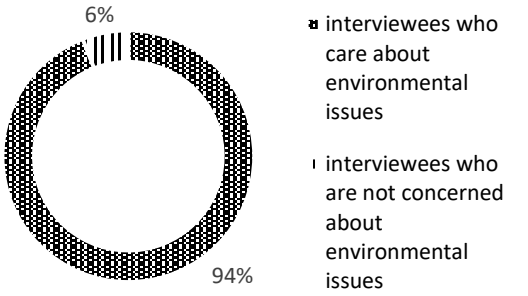


Fig.2. Distribution of respondents in relation to environmental problems
Source: author's research.

Nowadays, during the study of a number of disciplines at National University of Life and Environmental Sciences of Ukraine, teachers try to include new approaches in lectures and case studies, i.e. the analysis of economic activity should include the study not only economic components, but also necessarily environmental and social consequences of business.

Social-environmental approach in education and research activities are used in universities of European countries and the USA. Indeed, socio-ecological components include studying about sustainable development and natural resource management, development of alternative energy sources, ensuring the quality and safety of food and so on [7].

Therefore, students have the opportunity to process information about the state of the natural environment, to analyse primarily the impact of economic activity on it, to assess the availability and use of natural resources, the level of expenses for environmental protection and the principles of implementing the state's environmental policy.

Basic data that could be taken from the state statistics on the environment relates to the following topics: emissions of pollutants and greenhouse gasses; generation and management of waste; environmental protection costs and environmental payments; use of fertilizers and pesticides for the harvest of agricultural crops; organic farming, etc.

The environment in Ukraine is polluted due to green house emissions, forest fires for 23 thousand ha [3], chemical fertilization of the soil and plant protection, heavy metals in the ground water. As a result, wild flora and fauna, biodiversity in general is also affected.

All these aspects have been accentuated since the year 2022 when the country was invaded by Russia.

Under these conditions, the awareness about the environmental issues increase in 88.2% of respondents.

At the same time, 64.7% of students believe that the hostilities significantly influenced the deepening of their environmental awareness.

Analyzing the theme of environmental problems, 44.1% of students worry about the environmental consequences and 5.9% about greenhouse gas emissions; half of the

surveyed students consider the problems of ecology comprehensively.

According to our research, the main sources of information about ecology and environmental protection were social networks (44.1%); internet sources (41.2%); television (11.8%) and press (2.9%) (Fig.3). At the same time, 20.6% of students believe that information about environmental behaviour is easily accessible, 52.9% accessible, and 26.5% difficult accessible.

According to the vast majority of surveyed youth, the topic of ecology is not popular enough in the mass media (79.4%), only 8.8% believe that it is excessively popular, and 11.8% believe that it is sufficiently popular.

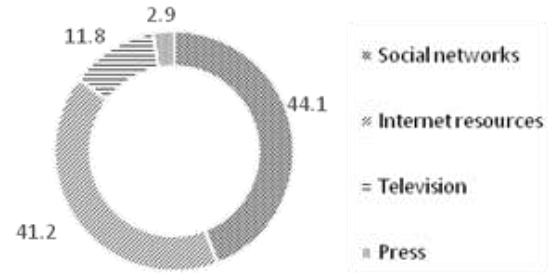


Fig. 3. The structure of the main sources of information about ecology used by students of NULES of Ukraine
Source: author's research.

In order to summarize the peculiarities of the formation of the environmental awareness of the population in Ukraine, we made SWOT-analysis to identify the main areas of improvement within the environmental policy in Ukraine (Table 1).

Table 1. SWOT-Analysis of the environmental awareness of the population in Ukraine and the main directions of increasing youth environmental awareness

| **Strengths** | **Weaknesses** |
|---|---|
| The majority of Ukrainians have an ecocentric type of eco-awareness and a desire for a harmonious interaction between people and the environment.<br>In recent years, the number of Ukrainians, who are members of environmental organizations has increased. They cooperate with parliamentarians and government officials on the implementation of environmental initiatives.<br>The development of environmental awareness of the population is defined as one of the goals of Ukraine's environmental policy.<br>The choice of environmental protection measures was influenced by the welfare of the interviewees (persons with a high and medium level of wealth are more inclined to environmental protection measures).<br>Environmental protection measures are more common among respondents with secondary specialized and higher education. | (1) Till the year 2020, there was a tendency to decrease the value of the environment compare to economic values of Ukrainians.<br>(2) The share of eco-activists is insignificant among the population.<br>(3) In comparison with the EU countries, there is almost no information on the adoption of environmental regulations and the implementation of environmental policy on the websites of Ukrainian state bodies.<br>(4) Authorities do not always make decisions that take into account the risks of harming the environment. |
| **Opportunities** | **Threats** |
| At the state level, the rules of conduct and norms of responsibility for environmental offenses should be improved.<br>The creation of appropriate infrastructure for the population to fulfil its environmental responsibilities directly affects the population's readiness to take real actions to preserve the environment.<br>It is important actively highlight environmental issues in the mass media and social networks.<br>Non-governmental nature protection organizations play an important role in raising the public's awareness of environmental problems, and they also indirectly create a public demand for state changes in the field of ecology and influence the formation of environmental consciousness of civil servants.<br>In Ukraine, the development, adoption and implementation of the national program of environmental education in educational institutions are important.<br>Natural sciences universities can play an important role in raising the awareness of the population and youth about ways to solve environmental problems. | In practice, the willingness of Ukrainians to take actions to preserve the environment is low.<br>It is necessary to detail the environmental policy and determine its priorities in the future strategy.<br>The formation of environmental awareness and ecological values of the population is influenced by environmental regulations and measures taken by the state to ensure their implementation (environmental control, responsibility, etc.), as well as the collection and distribution of environmental statistical data. In Ukraine, there are certain shortcomings in the mechanisms of environmental control and legal responsibility in this area. The database with current information on the state of the environment also needs special attention, state environmental monitoring was carried out in a fragmented manner.<br>In Ukraine, there are no large-scale sociological studies commissioned by the state about the state of environmental awareness.<br>Lack of funding sources for measures to increase environmental awareness and development of methodical, didactic and educational materials aimed at forming a culture of ecological behaviour, sustainable consumption and environmental ethics. |

Source: developed by the authors based on Kuts, N., 2020 [6].

Education and educational activities are key importance for the formation of

environmental awareness. The formation of the ecological consciousness of young people is based on ensuring the consistency of formal and informal educational activities.

Natural sciences universities can play an important role in raising the awareness of the population and youth about ways to solve environmental problems by highlighting research results in scientific and popular publications, preparing books and disseminating environmental information.

Teachers should involve students and youth in conducting online courses, trainings, seminars and conferences on environmental topics for stakeholders.

Indeed, scientific and pedagogical teams can develop and implement advanced training courses in the field of environment.

In turn, scientists of various specialties should be involved in explaining the importance and methods of implementing environmental solutions at the business, community, and state levels; develop concrete measures to solve environmental problems at the level of local communities, etc.

## CONCLUSIONS

Environmental awareness is the growth and development of consciousness, understanding toward natural environment protection and the activities that can cause harm to the environment. In Ukraine, people generally consider environmental protection important and are concerned about its problems.

Environmental awareness is measured by a level that can change during a person's life due to influence of different factors.

The aim of the paper was to analyse environment awareness among students of the Economic faculty of NULES of Ukraine. To realize this purpose, answers on the following questions were found: (1) What sources of information do students use in order to be aware of environmental problems? (2) Do the hostilities in Ukraine influenced on the youth awareness increase about the environment problems? (3) What priority measures should be implemented to solve environmental problems under the present conditions?

Using the Statistical survey method, we got 94 correctly filled in questionnaires, which were chosen for our research. In the sample 85% were women that could be explain by similar distribution by gender at the faculty.

Despite on the difference of geographically place of birth and grew up, 95% of students concerned about environmental problems.

Research results showed that the main sources of information on the environment theme were social networks (44.1%); internet sources (41.2%); television (11.8%) and press (2.9%). Besides, 20.6% of respondents considered about easily accessible of information about environmental behaviour, 52.9% accessible, and 26.5% difficult accessible. In addition, 79% of students believed that the environmental theme is not popular enough in the mass media, only 8.8% considered that it is excessively popular, and 11.8% thought that it is sufficiently popular.

Research results confirmed the awareness increase about the environmental issues in 88.2% of respondents. Indeed, 44.1% of students worry about the environmental consequences of the hostilities.

Education plays a leading role in the formation of environmental awareness among students.

It is necessary to improve and implement legislative, institutional and budgetary solutions in order to solve the environmental problems.

One of the important directions of this can be the concept of continuous environmental education and educational work (primarily of life and natural sciences universities) with all categories of the population, laying down funds in the budget for the implementation of these measures, attracting international financial assistance, public-private partnership mechanisms, etc.

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# RESEARCH ON WINTER WHEAT, CORN AND SUNFLOWER CROPS PROTECTION IN ILFOV COUNTY RESPECTING NATIONAL LEGISLATION

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***Abstract***

*Plant health (in this case winter wheat, corn and sunflower crops) is fundamental to the sustainability and competitiveness of agriculture, food safety and environmental protection. Currently, modern winter wheat, corn and* sunflower *crop protection strategies are focused on combating harmful organisms (diseases, weeds and pests) that cause quantitative and qualitative losses to these crops. The research in this paper focused on the presentation of all plant protection products applied to wheat, corn and sunflower crops by 50 farmers from Ilfov county in the 2019 agricultural year. The assortment of fungicides, insecticides and herbicides used is extremely varied. We also made observations in the field to identify which diseases and pests were present in the crops and consulted the farmers on the extent of their control. The degree of attack of powdery mildew, two weeks after the application of the treatments, was calculated based on the incidence and severity of the diseases. The diagnosis of diseases was made by visual observation of the typical symptoms of their manifestations. Information from farmers was obtained on the basis of questionnaires. Total control of weeds in farmers' crops was provided by an assortment represented by 8 wheat herbicides, 2 sunflower herbicides and 10 maize herbicides. Due to environmental concerns and concern for human health, the application of products for the protection of wheat, corn and sunflower crops was done taking into account good practices in the context of promoting integrated management of diseases, weeds and pests according to European directive 2009/128/EC.*

***Key words*****:** *plant healt, diseases, weeds, pests, crops protection products, wheat, corn, sunflower*

## INTRODUCTION

Agricultural production, which also includes the cultivation of wheat, corn and sunflower, constitutes the main activity of the rural society. This production, however efficient it may be, cannot be obtained without the activities of prevention and control of diseases, weeds and pests that agricultural crops face.

In Romania, according to Baicu and Săvescu (1986) [2], with all the progress made regarding varieties and hybrids, culture technologies, prevention and control methodologies, the damage caused by diseases, weeds and pests, in the years favorable to these bioaggressors, is quite high. Thus, wheat losses caused by diseases are approx. 11%, pests get 10% and weeds 12%. In corn, the losses caused by diseases are approx. 9%, pests get 14% and weeds 13%. In sunflower, each of the three categories of bioaggressors causes 10% losses.

Worldwide, it is estimated that the losses caused by diseases and pests are approx. 30-40% of agricultural production (Guest, 2017) [13].

Plant protection in the current context (use of as few chemical products as possible to avoid environmental pollution) is more and more acute.

Chemical control is still an indispensable method in the effective protection of wheat, corn and sunflower in Romania against diseases, weeds and pests.

Crop inspection during the growing season for diseases, weeds and pests is of particular importance in their management (Zală et al., 2023) [29].

The potential losses recorded in agricultural crops in the absence of the use of plant protection products far exceed their value.

Plant protection products (PPPs) are substances in various conditioning forms used for the protection of agricultural crops against diseases, weeds and pests, and which sometimes help the process of plant growth and development and are indispensable in agricultural production (Strassemeyer et al., 2017; Tudi et al., 2021) [21, 23].

PPPs may contain one or more active substances. Any active substance must be approved at the level of the European Union, and then plant protection products are authorized by the member states.

Plant protection products can be used by professionals and individuals, because thei are indispensable in agricultural production (Bernardes et al., 2015; Lamichhane, 2017) [5, 14].

The sustainable use of plant protection products, in the sense of the provisions of the Government Emergency Ordinance no. 34/2012 [10] for the establishment of the institutional framework for action for the purpose of the sustainable use of pesticides on the territory of Romania, approved by Law no. 63/2013 [15]., represents an essential objective for obtaining a sustainable agricultural production, and implicitly, for ensuring a competitive agricultural system at the European and international level.

Crop protection measures for winter wheat, corn and sunflower have the potential to contribute to the wider objective of ensuring economic, ecological and social sustainability of primary production.

Wheat, corn and sunflower production play a critical role in achieving sustainable and competitive agriculture sectors and the protection of biodiversity and ecosystems. Therefore, keeping plants healthy is not only important, it is absolutely vital [11].

Farmers have every interest to monitor the health of the crops in order to notice in time the appearance of dangerous weeds, pests or diseases, whose presence in the ecosystem of wheat, corn and sunflower slows down the development of the plants and generally damages the quality and quantity crops.

In Romania, phytosanitary legislation (from 2000 to the present) consists of 2 ordinances (OG 136/2000, OUG 201/2008), 4 laws (214/2001, 37/2006, 93/2007, 165/2009); 24 orders (560/2002, 912/2004, 653/2006, 585/2007, 586/2007, 698/2007, 686/2007, 378/2007, 387/2007, 583/2007, 579/2007, 580/2007); and 13 decisions (1135/2007, 1085/2008, 441/2009, 107/2009, 1566/2009, 259/2010, 5/2011, 352/2014, 810/2014, 1030/2014, 563/2007, 19/ 2018, 599/2019).

Weeds are unwanted plants that must be fought because they compete with crops for different resources: light, soil nutrients, water and growing space (Botha, 2001; Budoi et. al., 1994) [6, 7].

By their nature, weeds grow and multiply faster than agricultural crops, and due to the fact that their seeds remain in the soil for several years, they have a short lifespan, with several generations in the same growing season, they cause quantitative and qualitative damage to the harvest (Berca, 2004; Saupe, 2009) [4, 18].

Production losses in the wheat crop due to weeds can be 20-40% (Ahmad and Shaikh, 2003) [1].

Maize and sunflowers are strongly weeded regardless of the area in which they are grown because the nutrition space is wide and allows that in the first phenophases of development the crops are attacked by numerous weed species that are favored by the sunlight that falls directly on the soil , as well as the humidity that is usually sufficient for seed germination (Berca and Ciorlăuș, 1994; Courtney, 1996) [3, 9].

Production losses in the corn crop due to weeds reach 16-40% (Valverde et al., 1995) [24].

In the sunflower culture, weeds cause great damage, and production losses reach up to 60-90% [26].

At the national level, the area cultivated with grain corn in 2019 represents 47.9% of the area cultivated with grains for grains, and that cultivated with wheat 38.8%. In Romania, the area cultivated with corn was 2,599,000 ha. (with an average production of 6,524 kg/ha.), that with wheat was 2,106,000 ha. (with an average production of 4,687 kg/ha.), and that with sunflowers was 1,306,000 ha. (with an average production of 2,642 kg/ha.)

In 2019, Romania ranked first among the member states of the European Union in terms of cultivated area and production of grain corn and sunflower [17].
In Ilfov county, the highest corn production, 10,590 kg/ha., was achieved by farmer Daniel Drăghici with hybrid P0023.
In sunflower, the farmer Cosmin Iancu obtained 4,060 kg/ha with the hybrid P64LE136.
In this context, this research paper is focused on the presentation of all plant protection products applied to wheat, corn and sunflower crops by 50 farmers from Ilfov county in the 2019 agricultural year.

## MATERIALS AND METHODS

Among the working methods was the opinion poll, which is based on a questionnaire (Shapiro, 2001) [19].
Visual observation is the fastest method for identifying diseases of wheat, corn and sunflower based on the typical symptoms shown by the infected plants, as well as for identifying pests and weeds present based on their morphological characters. 100 plants were noted in 4 points for each of the variants with fungicides and insecticides applied to wheat.
The degree of attack of powdery mildew and septoria leaf blotch on wheat, two weeks after the application of different fungicides, was calculated based on the incidence (frequency) and severity (intensity) of the diseases. Integrated weed control measures on a farm take into account their mapping.
The mapping of weeds in the wheat culture is performed a few days before the application of herbicides; while for corn and sunflower crops, it takes place 4 weeks before harvest (Chirilă, 1989) [8].
All treatments were applied respecting European directive 2009/128/EC [12].

## RESULTS AND DISCUSSIONS

In 2019, we conducted a study among 50 small farmers, large crop growers, from Ilfov county, regarding the products used for the protection of sunflower, corn and wheat crops against diseases, weeds and pests.
From the questionnaires completed by these farmers, regarding the fungicides intended for seed treatment, they have Maxim XL 035 FS (5 l/t) and Apron XL 350 ES (3 l/t) for sunflowers and Maxim XL 035 FS (3 l/t) for corn; the seed being bought already treated.
Sunflower seeds are treated to protect them against fungi: *Sclerotinia sclerotiorum*, *Botrytis cinerea*, *Phomopsis* ssp. and *Plasmopara halstedii*, while the treatment of corn seeds was applied against the fungi *Sporisorium reilianum*, *Fusarium* spp. and *Penicillium* spp. [16, 22].
Against the corn and sunflower maize leaf weevil (*Tanymecus dilaticollis*), the seed was treated centrally with Nuprid® AL 600 FS (8 l/t), thanks to the derogation received by our country from the European Commission directive no. 485/2013 restricting imidacloprid. As treatment for wheat seed, the fungicides used were: Amiral Proffy 6 FS dose 0.5l/t (8%), Rancona 15 ME dose 1l/t (4%), Rancona I-Mix dose 1l/t (5%), Difend 2l/t (24%), Difend Extra dose 2l/t (30%), Systiva 333 FS dose of 1.5 l/t (19%), Celest Extra dose of 2 l/t. (10%) against the fungi *Fusarium* spp., *Tilletia caries*, *T. controversa*, *Parastagonospora nodorum* and *Ustilago* spp. (Figure 1).

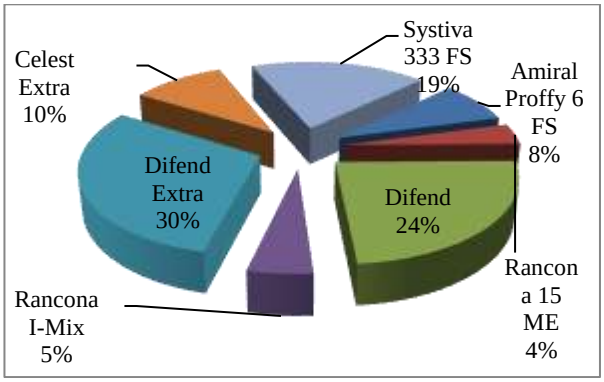


Fig. 1. Fungicides used for the treatment of wheat seeds
Source: Own design and calculation.

All surveyed farmers applied Signal 300 ES as an insecticide for the treatment of wheat seeds at a dose of 2.5 l/t.
The seeds can be treated ahead of time or a few hours before sowing.

The treatment applied to the seeds has the role of protecting the young plant from possible infections on the surface and inside the seeds as well as in the germinative zone.

Regarding the autumn wheat herbicide for the problem weed species *Avena fatua* and *Apera spica-venti*, 60% of the farmers surveyed applied one of the herbicides Bizon, Axial One, Foxtrot 69 EW or Pallace 75 WG (Table 1.). They herbicided in the development phase BBCH 23: 3 detectable tillers (Zadoks et al., 1974) [27].

Table 1. The number of farmers who weeded in the fall

| The herbicide applied | Dosage (l, kg/ha) | Number of farmers | The time of application |
|---|---|---|---|
| Bizon | 1.0 | 3 | BBCH 11-23 |
| Axial One | 0.75-1.0 | 13 | BBCH 11-39 |
| Foxtrot 69 EW | 0.9-1.1.0 | 4 | BBCH 11-23 |
| Pallace 75 WG | 0,25 | 10 | BBCH 12-32 |

Source: Own research.

In the spring of 2019, we reported, at a single farmer, the presence of downy mildew (*Plasmopara halstedii*)on sunflowers in the phenophase of 6 pairs of leaves-BBCH 16 (Weber and Bleiholder, 1990)[25].

Pale green or greenish-yellow spots appeared on the upper side of the leaves of the infected plants, starting from their base towards the tip, occupying an important surface of the leaf, and on the lower side, strictly proportional to the chlorotic areas on the upper surface of the leaf, distinguish a white, dense fluff (Photo 1.), composed of sporangiophores and sporangia of the oomycete (Zală, 2014) [29].

Photo 1. Sunflower plant with downy mildew attack
Source: Original (Lipianu, S).

Because of this, biomass production of vegetative and generative parts is drastically reduced (Spring et al., 1991) [20].

To stop the downy mildew attack, we recommended the emergency application of the fungicide Electis 75 WG (mancozeb 68.5% + Zoxamid-hexamethylenetetramine 8.8%) - 1.5 kg/ha.

On sunflowers, we also noticed the presence of dark brown spots on the leaves, of an irregular shape, arranged mainly towards the tip, typical of septoria leaf spot, caused by the *Septoria helianthi* fungus (Photo 2).

Common rust (*Puccinia sorghi*) appeared sporadically in corn, through blackish pustules (Photo 3) full of teliospores.

These diseases were not economically important.

Photo 2. Septoria leaf spot

Photo 3. Common rust
Source: Orig. (Lipianu, S.).

Treatments against foliar diseases were applied to wheat, among which powdery mildew-*Blumeria graminis* f.sp. *tritici* and septoria leaf blotch-*Zymoseptoria tritici* (Photo 4); of pests (especially against bedbugs and aphids; as well as for weed control.

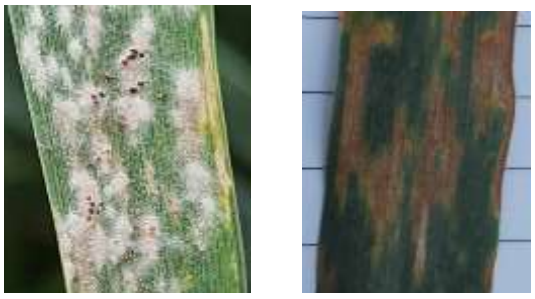

Photo 4. Wheat leaves with powdery mildew (left) and septoria leaf blotch attack (right)
Source: Original (Lipianu, S.)

The various fungicides and insecticides used by farmers to wheat can be found in Table 2.

We found that the assortment was represented by 6 fungicides and 4 insecticides.

Table 2. Fungicides and insecticides used for wheat

| Category | Trade name | Dosage (l or kg/ha) | Farmers who applied treatments (%) |
|---|---|---|---|
| **Fungicides** | Nativo 300 SC | 1.0 | 100 |
| | Falcon Pro | 0.6 | |
| | Zantara 216 EC | 1.0 | |
| | Evolus | 1.0 | |
| | Zakeo Xtra | 0.5 | |
| | Prosaro 250 EC | 0.75 | |
| **Insecticide** | Decis Expert 100 EC | 0.0625 | 100 |
| | Mospilan 20 SG | 0.1 | |
| | Vantex 60 EC | 0.08 | |
| | Alfadone 10 EC | 0.1 | |

Source: Own research.

In wheat, 23 farmers applied a number of three treatments to combat harmful agents, 21 farmers performed two treatments and only 6 farmers applied a single treatment.
The frequency of plants with powdery mildew symptoms after two weeks from the application of fungicides varied between 8.25% in the plots with Nativo 300 EC and 11.5% in the plots with Prosaro 250 EC (Fig.2).

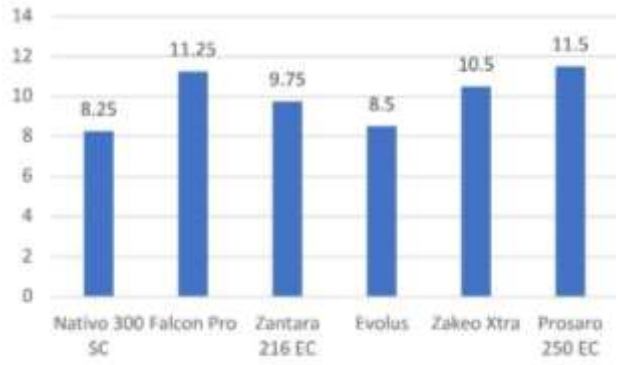


Fig. 2. Frequency of plants with powdery mildew symptoms
Source: Own research results.

The intensity of plants with powdery mildew symptoms after two weeks from the application of fungicides varied between 10.3% in the plots with Zakeo Xtra and 12.7% in the plots with Falcon Pro (Fig. 3).

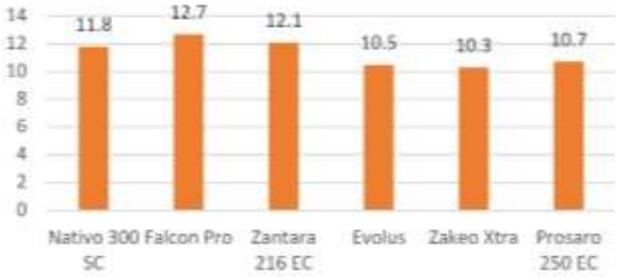


Fig. 3. Wheat powdery mildew intensity values
Source: Own research results.

The degree attack of powdery mildew varied between 0.9% in the plots treated with the Evolus fungicide and 1.43% in the plots treated with falcon Pro (Fig. 4).


Fig. 4. Degree attack on powdery mildew
Source: Own research results.

After inspecting the plots with wheat, 3 days after the application of the treatments with the various insecticides, we found the presence of only 2.4 aphids/plant in the plots where Decis Expert 100 EC was applied; 1.9 aphids/plant in the plots where Mospilan 20 SG was applied; 2.1 aphids/plant in plots where Vantex 60 EC was applied and 2.6 aphids/plant in plots where Alfadone 10 EC was applied.
Regarding the presence of bed bugs, their density was below 1 larva/$m^2$.
The assortment of herbicides applied to combat wheat weeds by the interviewed farmers consisted of 8 herbicides. The favorable influence of the application of different herbicides to wheat, regardless of the number and density of weed species, was manifested by a total control of them in the plots monitored after 3 weeks from the herbicide (Table 3).

Table 3. The result of applying herbicides to wheat

| Herbicide | No weeds/m$^2$ before herbicide | % weed destruction |
|---|---|---|
| Granstar Super 50 SG | 389.4 | 100 |
| Concordia 306 SE | 422.8 | |
| Alliance 660 WG | 455.1 | |
| Rival Top 20 SG | 374.1 | |
| Floramix | 295.7 | |
| Harmony 50 SG | 390.5 | |
| Trimmer 50 WG | 435.3 | |
| Omnera | 403.2 | |

Source: Own research results.

Regarding sunflower weed control, 17 of the farmers used Pulsar Plus-1.5 l/ha, which means they opted for Clearfield Plus production technology.
The other 33 farmers questioned applied Express™ 50 SG – 30g/ha herbicide resistant sunflower hybrid cultivation technology.
Thanks to these technologies chosen for weed control, when the sunflower plots were inspected, one month before harvest, they were free of weeds.
All surveyed farmers applied herbicides to maize. Depending on the spectrum of weeds they are dealing with, most of them, 47 of them, chose to apply two weedicides each (pre-emergence and post-emergence) and only three of them applied a single post-emergence weedicide.
The range of herbicides that ensured the farmers weed-free fields, as we could observe one month before harvest, can be found in Table 4.

Table 4. Herbicides used, target weeds and timing of application

| Herbicide | Dosage (l, kg/ha) | Weeds combated | Application time |
|---|---|---|---|
| Elumis | 2.0 | Monocotyledonous and dicotyledonous annual and perennial | BBCH 12-18 |
| Pyxides | 0.6 | | BBCH 12-19 |
| Arigo | 0.33 | | BBCH 12-14 |
| Equip | 2.0 | Monocotyledonous annual and perennial and dicotyledonous annual | BBCH 12-14 |
| Principal | 0.09 | | |
| Mustang | 0.6 | Dicotyledonous annual and perennial | BBCH 14-16 |
| Adengo 465 SC | 0.4 | Monocotyledonous and dicotyledonous annual | BBCH 12-13 |
| Laudis OD 66 | 2.0 | | BBCH 12-18 |
| Efica 960 EC | 1.5 | Monocotyledonousannual and some dicotyledonous annual | Preemergence |
| Dual Gold 960 EC | | | |

Source: Own research results.

## CONCLUSIONS

Currently, due to the preparation form and the high quality of the products intended for seed treatment, they are easily applied and the distribution on the surface of the seeds is uniform; the germination capacity of the seeds is not affected. Accurate diagnosis of diseases, pests and weeds in wheat, corn and sunflower crops is the main activity in managing the problems induced by these bioaggressors.
The application of fungicides against wheat powdery mildew had a very good result, so that the degree of attack of this mycosis had very low values in all treated plots. All surveyed farmers applied phytosanitary treatments against diseases, weeds and pests to wheat, corn and sunflower crops, they used high quality products because they wanted this quality to be reflected in production.
Regardless of the number and density of weed species whose variation from one plot to another can be influenced by different factors (soil water supply, previous crop, crop density, etc.), the application of herbicides to wheat caused their total destruction .
Losses caused to wheat, maize and sunflower crops by diseases, weeds and pests are a major problem anywhere in the world, and for this reason measures must be taken to ensure high and quality yields to reduce rural poverty and increasing security food. The protection of wheat, corn and sunflower crops against diseases, weeds and pests is required as an important sequence of the integrated technological system of their cultivation. Accurate knowledge of the weed structure of all plots is an important link in integrated weed control

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# RESEARCH ON THE IMPORTANCE OF PROFESSIONAL TRAINING AND SPECIALIST ADVICE FOR FARMERS - A STUDY CASE REGARDING PLANT PROTECTION IN TOMATO GROWING IN GREENHOUSES

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***Abstract***

*Professional training and consulting systems in the field of plant protection, and not only, are of particular importance for our country in the context of agricultural policies developed at the level of the European Union. The particularities specific to the implementation of community policies in Romania must be reflected in the level of specialization of agricultural specialists regarding their skills. Agricultural consultancy services represent a vital element in the field of informational and technological transfer in agriculture, providing farmers with information that can contribute to improving their standard of living and that of the rural population. From the research carried out, it appears that Romanian farmers need specialized consultancy in three directions: 1) preparation for accessing European Rural Development Program funds; 2) streamlining plant and animal production; 3) facilitating access to consultants on legal issues, cadastre, feasibility studies, marketing, management, etc. The paper also presents results regarding plant protection products used by farmers in Ilfov county in 2020. The purpose of the paper is assess the farmers knowledge where they could find valuable information to their problems regarding plant protection as reflection of their training level and of the efficiency of the consultancy system in Romania.The working method consisted of a sociological survey and an opinion poll. For technical advice, 28.0% of the surveyed farmers would turn to the Agricultural Directorate. For the use of plant protection products, 51.0% of farmers turned to their delivery company. An important shoulder of farmers, 71.0%, are not aware of the National Action Plan regarding the reduction of risks associated with the use of plant protection products. Most of the farmers, 45.0%, would turn to a private consultant to receive support in accessing European Rural Development Program funds.*

***Key words*****:** *consultancy, vocational training, farmers, plant protection in tomato growing*

## INTRODUCTION

In the current context, in which ensuring food safety and security are part of the sustainable development objectives that define the 2030 Agenda, increasing the responsibility among farmers and all factors involved in respecting good agricultural practices is a key objective in the sustainable management of environmental resources.

Compliance with good agricultural practices, starting from the transport, storage and actual administration of plant protection products, is a desire of the European Community, and not only that (MADR, 2023) [11].

In this context, it is becoming more and more evident that the integrated management of diseases, weeds and pests in agricultural vegetal crops focuses on obtaining healthy crops through good agricultural practices that aim at the safe application of plant protection products, a fact also reflected in the protection of the environment [13, 14, 15, 23, 24].

Tomatoes are the major vegetable crop in the world with a high importance in human diet, but its growing is facing with various problems especially related to plat protection which claim the advice of an export or consultant.

Disease, weed and pest control techniques attempt to achieve a balance between cost of control and crop yield loss and this control techniques can be selected to meet short-term economic and agricultural planning goals [27].

Plant health is fundamental to the sustainability and competitiveness of agriculture, food safety and environmental protection.

The training of farmers, distributors and consultants with the aim of the sustainable use of plant protection products falls under the observance of the legislative framework in Romania in accordance with the provisions of art. 5 para. (1) from OUG no. 34/2012 [17] for the establishment of the institutional framework of action for the purpose of the sustainable use of pesticides on the territory of Romania and Order no. 1356/1343/2018/51/2019 [18] of the Minister of Agriculture and Rural Development, the Minister of the Environment and the Minister of Health regarding the training and certification system for the sustainable use of plant protection products.

Considering that the training is an obligation of each member state of the European Union, of which Romania is also a part, the users of plant protection products in the agricultural sector (agricultural producers) have the obligation to register at the headquarters of the phytosanitary office in the the county in which it operates.

After training and passing a grid test, farmers receive a professional training certificate attesting to the acquisition of necessary knowledge regarding the sustainable use of plant protection products [12].

Agricultural consultants play an important role in bringing new knowledge and innovations to farmers, as scientists often lack the skills to implement innovations [8, 16].

The primary objective of agricultural consultants is to increase the economic value and net present value of their clients' agricultural business by helping them set realistic business goals and successfully achieve them [3, 7].

The role of consultants is becoming increasingly important as they are involved in a wide range of activities and are employed by farmers for their problem-solving and decision-making abilities [4, 5].

The agricultural consultant requires a full understanding of their clients' business and personal priorities and must have a vision to ensure the greatest increase in production [25], integrating and evaluating the impact of all factors on the whole activity [26].

As farmers come under pressure to comply with an increasing number of environmental rules and regulations, the role of a successful agricultural consultant due to his knowledge will increase [4, 5].

In most agricultural advisory case studies, farmers focused primarily on plant protection issues, followed by technology issues, while environmental issues came last [22].

For this reason, the consultants were involved in making recommendations to help solve some problems when some research in the field of environmental protection resulted in the withdrawal of a certain pesticide. Thus, at some point the majority of consultants and farmers came to the conclusion that the application of insecticides or fungicides in the form of dusts represents an essential problem for the environment and gave up the application of this type of treatment, currently using only phytosanitary treatments by spraying with water [2].

In Romania, as in the whole of Europe, the plant protection products market is regulated by Regulation (EC) no. 1107/2009 [19] of the European Parliament and of the Council of October 21, 2009 regarding the introduction of phytosanitary products on the market. This regulation establishes the rules for authorization of phytosanitary products presented in commercial form, their introduction on the market, use and control within the Community. This Regulation increases the level of protection of health and the environment, contributes to better protection of agricultural production, and enlarges and strengthens the internal market for plant protection products.

For farmers, it is necessary to have both knowledge specific to the agricultural field - e.g. diagnosing and combating diseases or pests, as well as skills related to business management, such as preparing a feasibility study for obtaining a loan.

Especially in these times when there is talk of „smart agriculture", high precision technique, high added value agriculture, but also more and more sophisticated agricultural production

marketing schemes, financial instruments available to farmers - the need becomes obvious for them to have access to all these news and innovations.

All this is all the more relevant in a country like Romania, whose numerous small and medium-sized farms have to produce really intelligently in order to be competitive and to survive on the market.

The pace of changes in the economic, technological or social environment in which farms operate has become, in the 21st century, so fast that farmers and entrepreneurs in the agri-food field need specialized support to keep up and integrate all these new technologies, practices and business models.

The agricultural knowledge and innovation system (Agricultural Knowledge and Information Systems - AKIS) is a concept that encompasses "people, organizations and agricultural institutions involved in generating, storing, transforming, retrieving, integrating, disseminating and using knowledge specific to this field, with the aim of to synergistically support decision-making, problem-solving and innovation in agriculture" [21].

There is no unified AKIS system in the countries of the European Union.

Specifically, each European country has built its own system depending on the institutional structure, the ownership status of research institutions and advisory organizations, the structure of education, sources of funding, the characteristics of farms and farmers - their needs and expectations, as well as and the implementation of the Common Agricultural Policy and national agricultural policies.

Agricultural consultancy represents one of the subsystems of AKIS.

The purpose of the paper is assess the farmers knowledge where they could find valuable information to their problems regarding plant protection as reflection of their training level and of the efficiency of the consultancy system in Romania.

## MATERIALS AND METHODS

The working method consisted of a sociological survey and an opinion poll.

The sociological investigation is a method of questioning social facts (opinions, attitudes, motivations, aspirations, personal characteristics and of the social environment) at the level of groups of people of different sizes and which allows the quantification of the data obtained in order to describe and explain them.

The sociological investigation is a complex method that includes various complementary methods: questionnaire, observation and document analysis.

The opinion survey represents a specific form of sociological investigation, being a statistical method of establishing, based on a sampling, the classification of opinions in relation to certain socio-demographic variables of the interviewed population. The opinion poll is based on a questionnaire.

## RESULTS AND DISCUSSIONS

Agricultural consulting in Romania appeared only after the fall of the communist regime. Prior to 1989, agriculture as part of the centralized economy was virtually unconsulted in the true sense of the word. There were only specialization courses for the heads of IAS and CAP organized by the County Agricultural Directorates and the Agronomist's House, and these were mostly oriented towards the technical aspects of production [9].

After the Revolution of 1989, Romanian agriculture entered a process of radical restructuring. It was only in 1998 that the foundations of the first organizational structures specialized in agricultural consultancy were laid, subordinated to the Ministry of Agriculture and Rural Development (MADR).

Then the National Agency for Agricultural Consultancy (ANCA) was created within the project financed by the European Commission through the PHARE pre-accession funds, with the aim of providing agricultural consultancy services to Romanian farmers.

At the regional level, the ANCA had under its authority the County Offices for Agricultural Consultancy (OJCA) in the 41 counties of the country, as well as the Agronomist's Houses.

For their part, the OJCAs had in their structure 546 Local Agricultural Consultancy Centers (CLCA) at the communal level [1].

Currently, the agricultural consultancy system in Romania is functional only in the state public system and is represented by a consultancy compartment within the 41 county agricultural directorates (technically and methodologically coordinated by the Ministry of Agriculture and Rural Development), and 450 centers communal technical assistance within the town halls [10].

These centers, which serve a number of 2,685 communes, the total number of these territorial administrative organizations in the country are usually represented by a single agronomist engineer from the town hall [10].

The issue of human resources in agricultural consultancy can no longer be ignored: now one agricultural consultant in the public system serves 12,000-13,000 farmers on the APIA farmer lists.

The experience of European states shows that an optimal ratio would be 1 consultant to 65-100 farmers.

At the level of Ilfov county, there are 41 communes and no Agricultural Consultancy Center.

Also, there is no private Agricultural Chamber in Ilfov County.

The Directorate for Agriculture of Ilfov County offers agricultural consultancy through the Service for the implementation of policies, strategies in agriculture and the food industry, agricultural consultancy and professional training.

At the agricultural consultancy and professional training department, a number of 2 employees are employed.

In Ilfov county, there are approximately 2.200 farmers who submitted payment requests to APIA.

During the years 2020, we undertook meeting sessions with a number of 364 small farmers from Ilfov county, the vegetable growers who grew tomatoes in the solar system.

In Ilfov county, vegetable farmers are the majority in the Southern extremity of the county, on the border with Giurgiu county and south of Bucharest, on the banks of the Sabar river, 81.37% of vegetable farmers are from the Vidra vegetable basin. The rest of the participating vegetable growers are from: Nuci (5.76%), Gruiu (4.67%), Copăceni (3.57%), Măgurele (2.19%), 1 Decembrie (0.82%), Berceni and Chitila (0.54% each), Jilava and Brănești (0.27% each). All the farmers had to fill out the holding sheet, where they declared the area of land owned and the phytosanitary treatments they applied.

Regarding the plant protection products applied to tomatoes in the greenhouse (Table 1), it can be observed that 43.0% of the farmers applied treatments against the *Pythium ultimum* pseudofungus (EPPO)[6].

Against leaf and fruit diseases of tomatoes, caused by different phytopathogenic agents, all surveyed farmers applied a number of 8 fungicides (Swhicth 62.5WG, Signum, Teldor, RidomilGold 68, Merpan 80 WDG, Cabrio Top, Polyram DF and Ortiva Top).

Table 1. Tomato treatments in the solarium

| The culture stage | Damage agent/ stimulating | The product used/ strength (%) | Farmers (%) who applied the treatment |
|---|---|---|---|
| Seedling | *Pythium ultimum* | Previcur Energy-0.1 | 43.0 |
| Floors 1-2-3 flowers and fruits | *Botrytis cinerea* | Swhicth 62,5WG-0.1 | 100.0 |
| | | Signum-0.15 | |
| | | Teldor-0.08 | |
| | *Phytophthora infestans, Fulvia fulva, Septoria lycopersici, Alternaria* sp. | RidomilGold 68WG-0.25 | 100.0 |
| | | Merpan 80 WDG-0.15 | |
| | | Cabrio Top-0.2 | |
| | | PolyramDF-0.2 | |
| | | Ortiva Top-0.1 | |
| | *Tuta absoluta* | Coragen-0.0175 | 40.0 |
| | *Helicoverpa armigera, Liriomyza trifolii* | Mospilan 20 SP-0.04 | 25.0 |
| | | Affirm-0.15 | |
| | | Laser 240 SC-0.05 | |
| | Mites | Vertimec 1.8 EC-0.08 | 11.0 |
| | Stimulating | Atonik-0.06 | 24.0 |
| | | Cropmax-0.2 | 4.6 |
| Before planting seedlings | Weeds | Sencor 600 EC-0.35 l/ha | 3.0 |

Source: EPPO [6].

Regarding the treatment against pests, 40.0% of vegetable growers applied treatments against *Tuta absoluta* and 25.0% against the species *Helicoverpa armigera* and *Liriomyza trifolii*.

To combat mites, 11.0% of vegetable growers applied Vertimec 1.8 EC.

Regarding the applied growth stimulants, 24.0% of farmers applied Atonik, and 4.6% applied Cropmax.

Only 3.0% of tomato producers herbicided with Sencor before planting seedlings.

The number of treatments carried out during the vegetation period of the tomato crop varied from one vegetable grower to another. Thus, 24.5% of the farmers applied 5, respectively 6; 21.0% applied 7 treatments; 15.0% of producers applied 4 treatments each; while 8 treatments applied 6.0%, 9 treatments applied 4.5%, 3 treatments applied 1.5%, 10 treatments applied 1.5% and 11 treatments mentioned 1.5% of farmers.

For questions (1-4) addressed in the questionnaire, the answers (%) were as follows:

**Question 1.** „***If you need technical advice in agriculture, who would you turn to***?".

Of the interviewees, 28% answered the Agricultural Directorate, 25% indicated newspapers, television and the Internet, 19% a private consultant/consulting firm, 17% a supplier of raw materials, another 10% would ask a more experienced neighbour or friend, and 1% would turn to an agricultural university/college/research center (Figure 1).

**Question 2.** ***„If you need information on the use of plant protection products, who would you turn to?"***.

The selected vegetable farmers answered: 51% a supplier of raw materials, 18% indicated newspapers, television and the Internet, 10% of respondents said the Agricultural Directorate, 10% answered the National Phytosanitary Authority, 9% would ask a more experienced neighbour or friend, and 2% would turn to an agricultural university/college/research center. This reflects the fact that the relationship with the distributor agent of plant protection materials or other products of interest for farmers is very strong.

The farmers are afraid to ask an advice from other sources (Figure 2).

**Question 3**. ***„Do you know the National Action Plan regarding reducing the risks associated with the use of plant protection products?".***

71% of the farmers answered that they had not heard, and 29% know that there are actions to reduce the risks associated with the use of plant protection products.

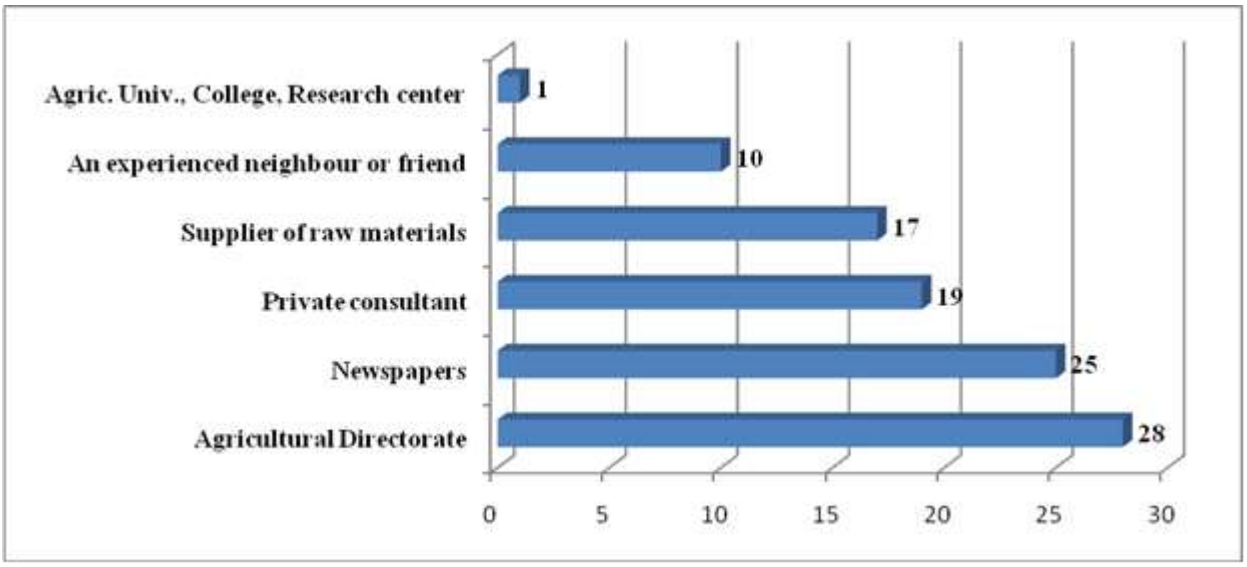


Fig.1. Farmers' answers to Question 1: "From where the farmers ask for technical advice?"
Source: Own results based on the Field Survey, 2023.

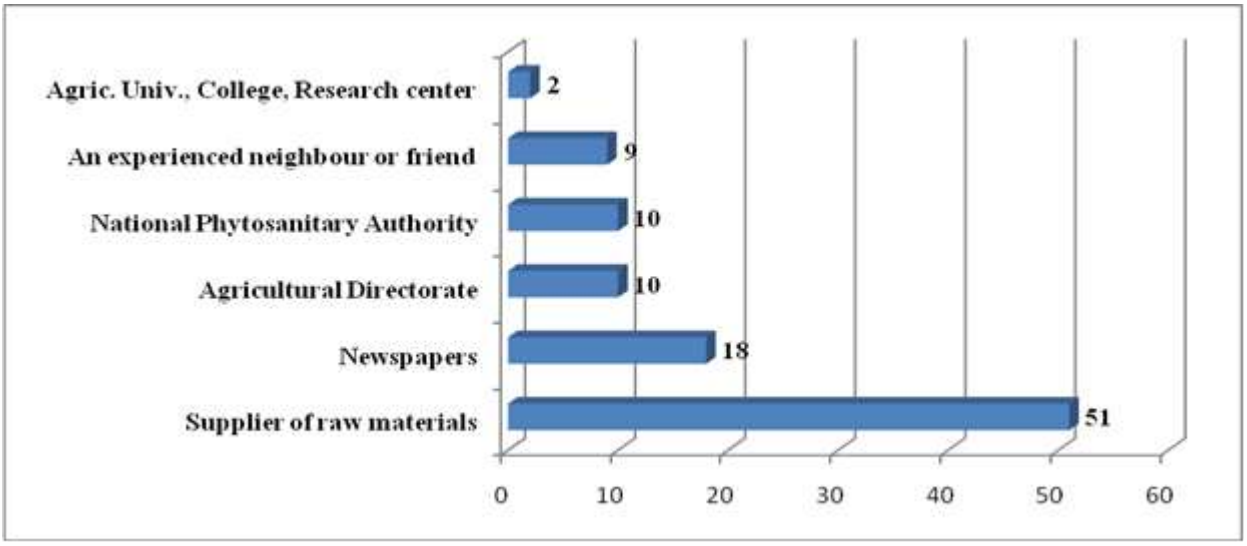


Fig. 2. Farmers' responses regarding to whom the they turn to get information of interest
Source: Own results based on Field Survey, 2023.

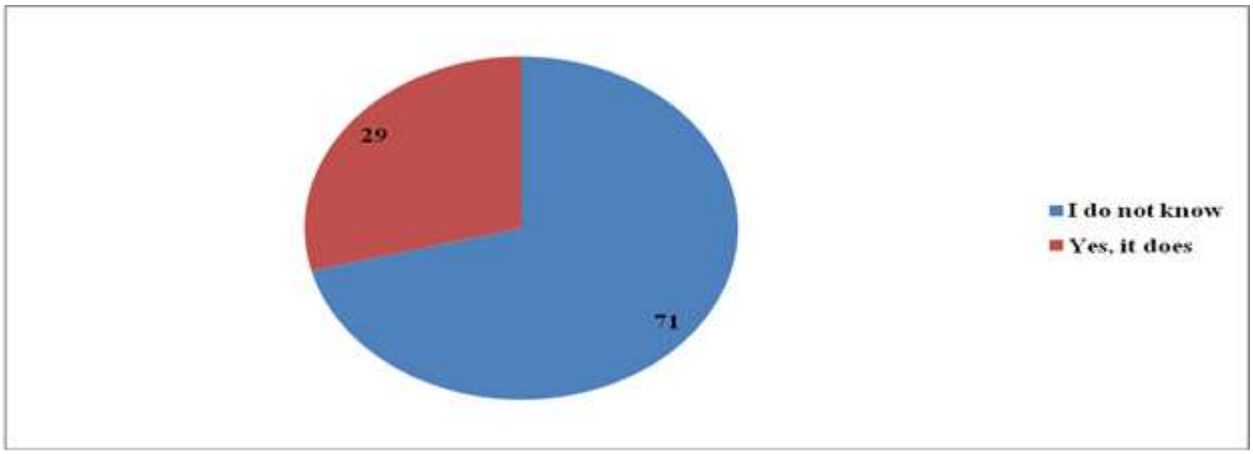


Fig. 3. Answers to Q3- Does the National Action Plan provides information on the risks linked to the use of plant protection products?
Source: Own results based on Field Survey, 2023

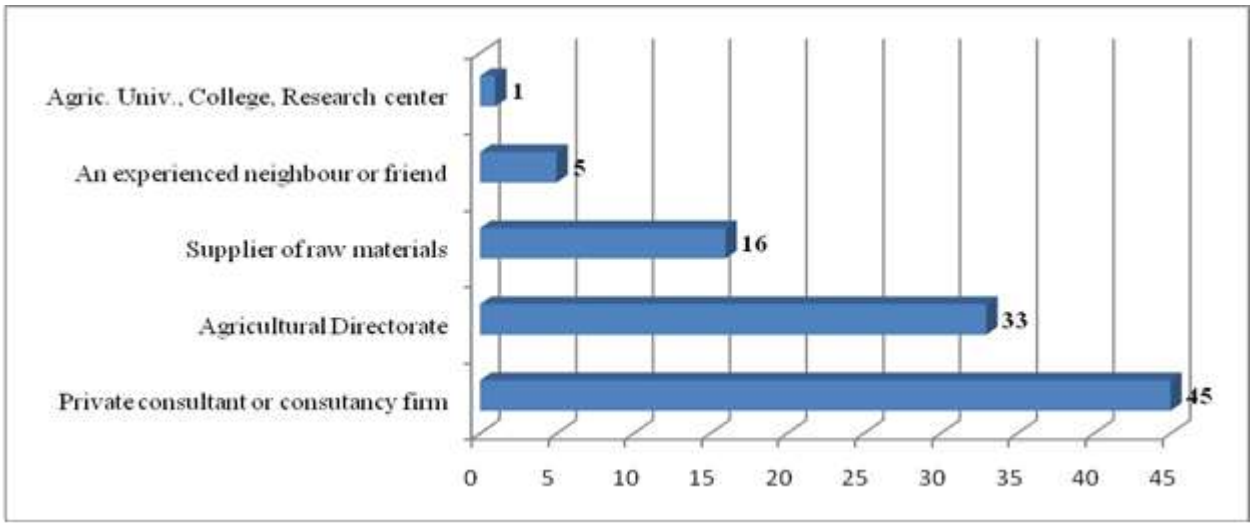


Fig. 4. Farmers' answers to Question 4: 'From whom they could ask for support for accessing European funds for rural development?"
Source: Own results based on Field Survey, 2023

The lack of information regarding the risk of using chemicals for plant protection reflects that the National Action Plan is not sufficiently promoted among farmers (Figure 3).

**Question 4. *„If you need support for accessing European Rural Development Program funds, who would you turn to?”.***

Of the respondents, 45% answered a private consultant/consulting firm, 33% of them indicated the Agricultural Directorate, 16% would address a supplier of raw materials, another 5% would ask a neighbour or a friend who has already accessed European funds, and 1% would turn to an agricultural university/college/research center ( Figure 4).

## CONCLUSIONS

In Romania, assessments of farmers' needs regarding agricultural consultancy services are needed, both from the point of view of the content of the consultancy: information, training needs, as well as of the preferred sources: which entities do they turn to, what do they trust, etc.

Consultancy must be accessible and within the physical proximity of the farmer.

The reconstruction of a functional and efficient agricultural consultancy system is a priority, not only from the perspective of the development needs of farmers, but also from the very access of Romania to the future funds for agriculture post-2020.

Agricultural consultancy services represent a vital element in the field of informational and technological transfer in agriculture, providing farmers with information that can contribute to improving their standard of living and that of the rural population [9].

Once a farmer has decided to engage the services of a crop protection consultant, in this case, they expect that consultant to be experienced, highly skilled and up-to-date with the latest technologies, which have the ability to ensure a qualitative (due to the use of, for example, biological insecticides) and quantitative (by saving possible losses caused by different biotic factors: phytopathogenic microorganisms, insects) production increase.

Regarding the fungicides and insecticides used to prevent and combat the attack of diseases and pests, all the vegetable growers interviewed applied approved products and in the recommended doses and concentrations; also, they respected the rest period between the last treatment and the start of harvesting.

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# GENERAL CHARACTERISTICS OF THE RURAL SPACE IN THE REPUBLIC OF MOLDOVA – ESSENTIAL FACTOR FOR THE PURPOSE OF PERFORMANCE REGISTRATION BY THE MANAGEMENT OF THE LOCAL PUBLIC ADMINISTRATION

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***Abstract***

*The knowledge, research and continuous development of the rural space is of increased interest for the academic environment in a country with imposing dimensions of the countryside such as the Republic of Moldova, dimensions marked both by the areas belonging to the rural environment and by the share of the population from villages. Despite a rapid urbanization, caused by the unprecedented industrialization of the second half of the 20th century, which generated not only a reduction in the share of the population employed in agriculture, forestry, fish farming, but also significantly decreased the share of income collected from agricultural activities in GDP , the importance of the rural space does not decrease, it is imposing itself more and more, including through the global trend of protecting the environment and capitalizing on the picturesque places available to the countryside. Humanity has set as its objective the greening of social and economic life, and the rural environment is of crucial importance in achieving it.*

***Key words*****:** *management, Moldova, public administration, rural space*

## INTRODUCTION

Vladimir Doga argues that "the countryside, in the banal but real sense of the term, appeared on the surface of the earth with the decentralization of man and the appearance of the first settlements for agricultural production. In historical time, a series of enduring relationships were created between rural societies and the land they took over, reinforced by traditions, customs and interests, expressed in the landscape through different types of rural spaces" [1, pp. 36].

Hence the etymology of the word "rural", which originates from the Latin "rurs" or "ruris", which implies the cultivation of fields or land occupied, inhabited, managed and processed by man.

Rural means land, land predominantly occupied by forests, seedbeds, green spaces, and the community in particular being an agrarian one.

Nowadays, "under the impact of urbanization, the countryside has undergone obvious structural changes, improvements and improvements to increase the productive capacity of the land, to modernize the rural habitat. The expansion of urban space, the development of communication routes, the establishment of non-agricultural activities, the introduction of techniques and technologies have led to the loading of rural space with new relationships, enriching it qualitatively and quantitatively" [8, pp. 36].

In this context, the aim of this research is to present the general characteristics of rural areas in the Republic of Moldova, in order to identify interconnections and points of convergence destined to improve the performance of local public administration management.

## MATERIALS AND METHODS

For this purpose, a combined qualitative and quantitative research was used with the aim of describing both the basic characteristics of rural areas and the way of life and living standards of the population in rural areas. In order to identify the specific characteristics and analyze the level of development of rural areas in the Republic of Moldova, the monographic method, induction, deduction, questionnaire and, last but not least, the analysis and synthesis of available statistical data were mainly used.

## RESULTS AND DISCUSSIONS

The term countryside has many approaches. In France, for example, it is considered to be the area where agricultural production predominates. In Belgium, the countryside is considered to be the territory cultivated by man and having a certain type of landscape. In Germany, all areas outside high-density areas are referred to as rural areas, and in the USA the basic criterion for referring to rural areas is the proportion of the total population" [10, pp. 104].

From the multitude of definitions given to the countryside we would like to review the following:

- "the countryside is not an abstract and ordinary area, but a human-geographical and heterogeneous one;
- the countryside includes the plains, farmers and all their activities, as well as non-urban areas;
- rural areas are socio-economic structures of greater diversity and complexity, including villages, small towns, farms, forests, production areas, small shops, commercial and tourist areas, with natural landscapes and diverse traditions;
- the countryside is considered as a concrete method of land use, which is characterized by low population density, natural landscapes, economic activities, especially related to agriculture, forestry and grazing" [5, pp. 29-30].

The vast majority of researchers clearly define the boundaries of the countryside, emphasizing that the countryside encompasses everything that is not urban. Usually, the rural area interacts with the urban area, because "it is precisely under the impact of urbanization that the rural area has experienced obvious structural changes related to the industrialization of rural spaces, mechanization, chemical processing, widely applied in agriculture, which has contributed significantly to the increase in production capacity and obviously led to the modernization of the rural habitat" [4, pp. 13-14].

"Another terminological confusion concerns 'rural area' and 'agrarian area'; 'rural activity' and 'agrarian activity' or, simply put, 'rural-agrarian'. It is important to note that the two concepts, although relatively similar, cannot be confused or considered synonymous. The scope of the notion of 'rural area', 'rural activity' and even the meaning of the term 'rural' in general is broader, more extensive, encompassing within it the notions of 'agrarian area', 'agrarian activity' or simply 'agrarian'. Controversy over a clear and precise definition of the countryside arises because the countryside itself is the subject of research for many sciences, such as economics, history, geography, sociology and even politics" [1, pp. 165-166]. Multidisciplinary approaches to this concept (Figure 1) reflect the specificity of the emergence and development of rural formations, and are a natural and, at the same time, necessary approach, considering the complexity of this term.

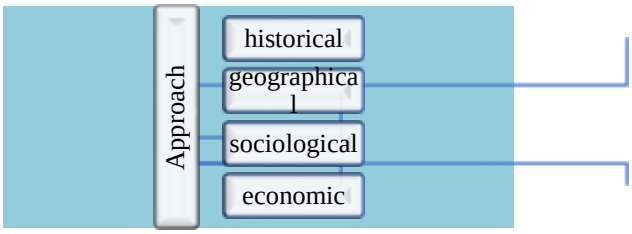


Fig. 1. Typology of approaches related to the definition of the concept of "countryside"
Source**:** Prepared by the authors on the basis of [5, pp. 31].

According to the *historical approach* "the countryside is an expression of long-standing human endeavor, designed to put the physical

and natural components of space at its service; it is a space that man has shaped over time according to his needs, which he has created through his work, and is thus a true rustic masterpiece of mankind" [4, pp. 13].

From a *geographical science perspective*, the term "countryside" is used to designate a well-defined geographical area characterized by a smaller population relatively isolated from the influence of large urban settlements.

*Sociology* bases rural areas on traditions, i.e. inter-human relations, a certain political and moral-spiritual life.

*The economic view* of the concept of 'countryside' once again underlines its key role in the economic development of a country.

All these approaches reveal numerous characteristics which, in sum, and presuppose all that is rural (Table 1).

Table 1. Specific characteristics of the approaches to the concept of "rural areas"

| **Specific characteristics of the approach:** | | | |
|---|---|---|---|
| **historical** | **geographical** | **sociological** | **economic** |
| The emergence of rural areas. | Geographical position. | Traditions and customs. | Rural economy. |
| Historical development and evolution of space rural. | Climatic conditions. | Lifestyle. | Basic production forces. |
| National specificity. | Occupations in rural areas. | Population number and density. | Agricultural and other types of industrial activities. |

Source: Elaborated by the authors based on [5, pp. 31]

Thus, through the elements it contains, the rural space is identified as a special space, different from other spaces that extend over a territory. The most important differences are in aspects such as economic structure, population density, dominant occupations, culture and cultural buildings, spiritual life, human relations, customs, etc.

According to the definition given in Recommendation No 1296/1996 of the Parliamentary Assembly of the Council of Europe on the European Charter for Rural Areas, "rural areas comprise an inland or coastal area including villages and small towns, where the majority of the land is used for:

-agriculture, forestry, aquaculture and fisheries;

-the economic and cultural activities of the inhabitants of these areas;

-development of non-urban leisure and recreation areas (or nature reserves);

-other purposes, such as the construction of housing" [10, pp. 104].

In our view, a clear, scientifically based definition of the countryside should draw on all of the above approaches. In addition, we would like to point out that it is also of interest that in European countries small towns are considered to be part of the countryside, which should be taken into account when formulating a definition.

Taking all these findings and statements into consideration, the authors come up with their own definition of the countryside, which they identify as *"a geographical area well determined by its authentic natural components, made up of small settlements populated by a small number of people united over time by common traditions and customs who make their living mainly from economic activities such as agriculture, forestry, grazing, crafts, handicrafts, practiced in aconscientious manner with a view to protecting the environment"*.

If we take into account the fact that the specific forms of human settlement in rural areas are villages and communes, the definition given by Romanian legislation in 1968 to these types of habitats becomes curious. Thus, the Law on the Administrative Organization of the Territory of the Socialist Republic of Romania states that a commune is an "administrative-territorial unit comprising the rural population united by a community of interests and traditions, consisting of one or more villages, depending on economic, socio-cultural, geographical and demographic conditions" [6, art. 5].

The legislation of the Republic of Moldova, under the influence of the directives developed by the EU through the European Charter for Rural Areas, completes the definition taken from the Romanians and identifies the village as "an administrative-

territorial unit comprising the rural population united by territory, geographical conditions, economic, social-cultural relations, traditions and customs, in which the majority of the labor force is concentrated in agriculture, forestry, fishing, providing a specific and viable way of life for its inhabitants, and which, through modernization policies, will preserve its rural specificity in the future" [7, art. 5].

Analyzing the definition given by the law, the question arises involuntarily how will peri-urban rural areas manage to preserve their rural specificity (areas bordering large cities and industrial centers), when these areas already have a significant urban footprint? The authentic countryside is increasingly absent here, being replaced by the foundations of urban life and culture, thus leading to the urbanization of villages. Another confusion arises when we refer to peripheral villages, whose recent decline is so serious that they are becoming rusticated. It follows that the definition given by Moldovan legislation is valid only for the intermediate rural area.

There are also question marks over who is responsible for implementing "modernization policies". Who is ultimately responsible for modernizing rural areas while preserving the rural character: the rural population, local public administration, state administration? All these inaccuracies mean that the law is not always easy to handle, which is why it needs to be supplemented by clearly stating who is responsible for the modernization policies implemented in rural areas and the obligation to preserve the rural character.

However, "in the context of a rural environment which, although it persists, is radically transformed compared to the traditional autonomous or semi-autonomous rural environment" [9, pp. 8], it is necessary to "allow human activities to take root, provided that they are not aggressive, promoting their degradation" [2, pp. 12].

The activities carried out predominantly in rural areas favor the identification of the functions of the countryside (Figure 2), functions which are based on the specific characteristics of the countryside and are also set out in the European Charter for Rural Areas.

*The economic function* of the countryside "is considered to be the basic, primary function, the main objective of which is the production of agricultural products and other material goods produced by productive branches such as agriculture, forestry, forestry industry, handicrafts" [2, pp. 12].

*The socio-cultural function* refers to relations within rural communities, which, unlike those in urban areas, are open, based on trust and friendship.

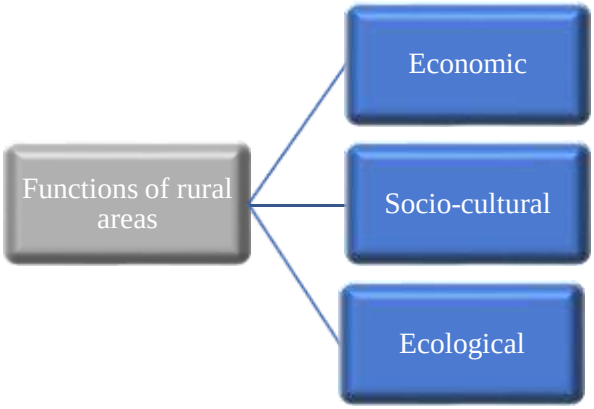


Fig. 2. Functions of rural areas
Source: Elaborated by the authors based on [4, pp. 16].

*The ecological function* calls for the rational and sustainable use of natural resources, the protection of the landscape and the specific features of the countryside, given the excessive industrialization in some areas which has led to "pollution of the countryside, deterioration of the agricultural and forestry landscape, an alarming reduction in flora and fauna and an imbalance in many ecosystems of the countryside" [2, pp. 13].

Starting from the functions of rural areas, the author aims to assess the level of development of rural areas through the analysis of official statistical data, although we are well aware that the consequences of pandemics and droughts have left their mark on the rural environment of the Republic of Moldova, which, at the moment, is experiencing acute economic and social problems, which are strongly connected to the socio-economic framework of rural life. Statistical data and specialist studies illustrate the insufficient

development of the country's rural areas, the general state of the village world in the Republic of Moldova being characterized by an inefficient economy, poor infrastructure and a low standard of living for the population.

The assessment of the level of development of rural localities should be analyzed from the perspective of the population's standard of living, including access to health services, education and culture. Last but not least, the author aims to analyze the degree of perpetuation of elements of natural capital.

To this end, we initially intend to analyze the share of land used for agricultural purposes in order to get a general impression of the proportions of the countryside. Subsequently, we will examine the standard of living of the rural population by taking into account the main sources of income, average wage level, average monthly income and expenditure. Particular attention will be paid to the analysis of the number of unemployed and the number of emigrants. Aspects of socio-cultural life will be analyzed in terms of the number of schools and high schools in the villages, the number of cultural and medical institutions, and investment in natural capital - by areas covered by forests and those tended and rebuilt.

The role of agriculture in rural life is explained by the fertility of soils, as well as by the continuous increase in the share of agricultural land in the total land area, thus, in 2020 their share was 61.81%, which exceeds the share held in 2019 by 0.56 percentage points (table 2). In general, the share held by agricultural land has shown an upward trend in the last 6 years, which gives hope for the possible revitalization of agriculture.

Although agricultural land comprises 2.09 million ha, the area sown by agricultural enterprises and peasant households in 2020 comprises only 1,538 thousand ha, of which 53.77% is sown by agricultural enterprises. We would like to point out that the size of the sown areas is constantly increasing, and since 2015, these areas have increased by 35 thousand ha.

Despite an increase in sown areas, the contribution of agriculture, forestry and fisheries to GDP formation is 2.0 percentage points lower in 2020 than in 2015. The statistics published for the first two quarters of 2021 also speak of the negative impact of agriculture, fisheries and forestry, which led to a 0.6% reduction in GDP. In this context, we would like to point out that in 2020 the contribution of agriculture, forestry and fisheries to GDP formation is practically equal to the contribution made by the construction branch. Here we would like to express our agreement with the position of Elena Timofti, according to whom "a problem in the management of the economic development of agriculture in the Republic of Moldova is the poor diffusion of innovations" [3, pp. 57].

Table 2. Estimated share of agricultural land in the total land area for the period 2015-2020

| **Indicators** | **Year** | | | | | |
|---|---|---|---|---|---|---|
| | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Total land, thousands ha. | 3,384.6 | 3,384.6 | 3,384.6 | 3,384.7 | 3,384.7 | 3,384.7 |
| Agricultural land, thousands ha. | 2,026.5 | 2,028.3 | 2,039.8 | 2,041.6 | 2,073.0 | 2,092.0 |
| Share of agricultural land in total land area, % | 59.87 | 59.93 | 60.7 | 60.32 | 61.25 | 61.81 |

Source: Own calculation.

Analyzing the employment level of the rural population (Table 3), we find that it is predominantly engaged in agriculture - 167.2 thousand people in 2020. However, we note a significant reduction in this indicator recorded in 2019 compared to 2018, when the number of rural populations engaged in agricultural activities decreased by 254 thousand people, people, who at best opted for another field of activity or remained without a stable job. One explanation for this phenomenon could again be the 2020 drought and the pandemic.

At the same time, we identify that the number of rural people who have opted for a job in the construction sector, since the period of 2017, is continuously increasing, reaching in 2020 a number of 35.2 thousand people, this is the only branch of the national economy in which the number of employed populations in rural

areas is increasing. If a comparison is to be made with the urban environment, there is a reduction in the number of people employed in all areas of activity.

In the following we aim to identify the average salaries offered to employees by field of activity in order to identify the most attractive branch. The statistical data presented in Figure 3 identifies the industrial sector (9,493.1 lei in 2020) as the sector with the highest average wage payment, which is the essence of the industrial-centric theory of economic development. According to this view, agriculture cannot develop without industry.

Table 3. Dynamics of the employed population by type of economic activity and average for the period 2015-2020, thousands of persons

| Population employed by economic activity | Year 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Agriculture, forestry and fisheries, total | 381.9 | 410.9 | 390.5 | 452.0 | 182.8 | 175.9 |
| Urban | 23.5 | 26.7 | 22.3 | 24.9 | 9.7 | 8.6 |
| *Rural* | . | *384.2* | *368.2* | *427.1* | *173.1* | *167.2* |
| Industry, total | 143.8 | 148.1 | 144.4 | 147.3 | 128 | 121.4 |
| Urban | 93.8 | 97.1 | 92.5 | 92.6 | 60.6 | 57 |
| *Rural* | *54.5* | *51.0* | *51.8* | *54.7* | *67.5* | *64.4* |
| Construction, total | 65.4 | 60.9 | 56.6 | 59.5 | 61.4 | 60.4 |
| Urban | 36.1 | 33.5 | 30.5 | 30.4 | 27.8 | 25.3 |
| *Rural* | *29.2* | *27.4* | *26.1* | *29.1* | *33.6* | *35.2* |
| Trade, hotels and restaurants, total | 189.6 | 199.6 | 208.8 | 194.4 | 163.8 | 148.4 |
| Urban | 139.0 | 150.1 | 154.1 | 137.8 | 107.1 | 56.7 |
| *Rural* | *50.6* | *49.5* | *54.7* | *56.6* | *95.7* | *52.7* |

Source: Own calculation.

Thus, industry is the driving sector and agriculture is the sector to be set in motion. It is hard not to recognize the advantages of this theory, given that industry provides agriculture with the most modern production methods, the fruit of mechanics and especially chemistry, as well as supplying primary demand through the processing of agricultural products. But, however, it is regrettable to acknowledge that agriculture is the worst paid branch, with employees in this sector earning on average 6,072.6 lei in 2020, which is below the average wage forecast for the same period - 7,953 lei. Moreover, agriculture is the only branch whose remuneration does not reach the level of the average remuneration in the Republic.

Also, here we would like to note that the wages offered in construction are not much lower than those offered in industry. In 2020, an employee in the construction sector earns an average salary of 9,389.1 lei, which is only 104 lei less than in the industrial sector. This explains the migration of rural employees from agriculture to the construction sector.

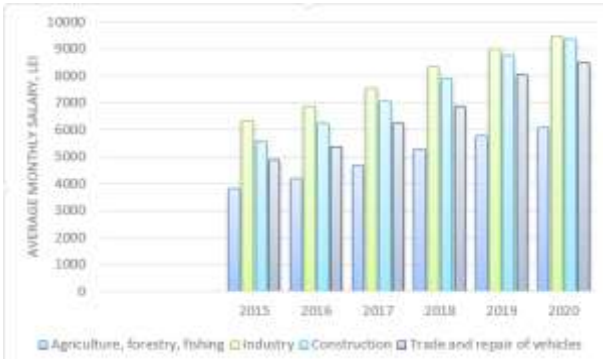


Fig. 3. Average monthly wage level by economic activity in dynamics
Source: Own calculation.

The importance of population in the development of any country is undeniable, but the role of the rural population is particularly important, especially since it accounts for 56.9% of the total number of people registered in 2019 (Table 4). However, we are forced to acknowledge that the number of rural populations per country in the period 2015-2019 shows a significant decrease of 32.7 thousand people. If we are to analyze the annual reductions in the rural population, we see that they occur regularly, thus in 2016 compared to 2015 the rural population decreased by 5.9 thousand people, in the period between 2017 and 2016 the villages lose another 7.9 thousand people, which is a 34% over the level of 2015-2016. In 2018, compared to 2017, the rural population decreases by another 8.5 thousand people, to lose another 10.4 thousand in 2019. Unfortunately, we cannot analyze the statistics for 2020 because the Statistical Yearbook no longer publishes the number of populations by environment, but the figures published by country for 2020 and January 2021 are alarming in the sense of a catastrophic reduction in the number of populations.

However, the number of people living in urban areas continues to grow, increasing by 20.2 thousand between 2015 and 2020.

The same situation can be seen if we analyze the share of the population by environment. The country, which recently boasted a significant proportion of rural population, risks reaching the point where these two values will be equal or the proportion of urban population will exceed the proportion of rural population. Thus, over 5 years the rural population share has decreased by 0.7%, while the urban population share has increased over the same period by 0.9%. Analyzing the rate of decline in the rural population, we dare to assume that in 25-30 years the rural will give way to the urban in terms of total population.

Table 4. Dynamics of demographic indicators recorded in the Republic of Moldova in the period years 2015-2020

| **Indicators** | **Year** | | | | | |
|---|---|---|---|---|---|---|
| | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Total population, thousands pers. | 3,555.2 | 3,553.1 | 3,550.9 | 3,547.5 | 3,542.7 | 2,640.4 |
| Population in urban areas, thousands pers. | 1,507.3 | 1,511.1 | 1,516.8 | 1,521.9 | 1,527.5 | - |
| Share of urban population, % | 42.4 | 42.5 | 42.7 | 42.9 | 43.1 | - |
| Population in rural areas, thousands pers. | 2,047.9 | 2,042.0 | 2,034.1 | 2,025.6 | 2,015.2 | - |
| Share of rural population, % | 57.6 | 57.5 | 57.3 | 57.1 | 56.9 | - |
| Urban employment rate, % | 42.0 | 42.3 | 41.9 | 40.9 | 47.0 | 44.4 |
| Rural employment rate, % | 38.9 | 39.7 | 39.3 | 42.8 | 36.6 | 35.1 |

Source: Own calculation.

The continuing decline in the rural employment rate is also disappointing, with a reduction of 3.8% over the period 2015-2021, which is well below the same rate in urban areas. If the employment rate in rural areas is 35.1% in 2020, it is 44.4% in urban areas.

Under these conditions, it is curious to note the reduction in the number of unemployed in rural areas, which in 2020 will be 15.5 thousand people, i.e., 10.5 thousand fewer than in 2019 (Figure 4). The same can be seen in the situation of the unemployed in cities, whose number has also decreased in the same period by 3.3 thousand people. Here again we are forced to note the effects of the pandemic in that until 2019 the number of unemployed registered in rural areas was constantly below the number of unemployed in urban areas, in 2019 it recorded a significant increase, and in 2020 - an equally significant reduction. If it is natural that the largest share of the unemployed should go to people with no schooling (10.6% primary school or no schooling), then why should 1.2% of the unemployed with higher education in rural areas in 2020 and 2.5% of the unemployed with secondary education?

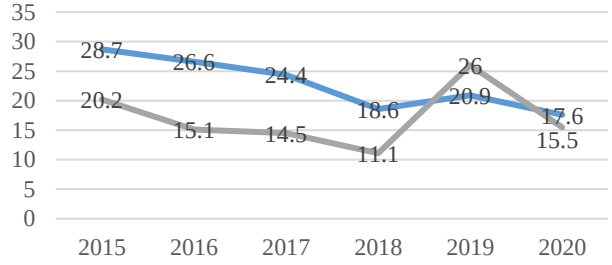


Fig. 4. Dynamics of the number of unemployed by background during 2015-2020
Source: Own calculation.

It is clear that qualified staff, rather than taking low-paid work, would rather join the ranks of the unemployed. The current situation is increasingly dissatisfying the rural population, who are leaving in droves to go abroad in the hope of making a decent living. Statistics for 2020 show that most people leaving in search of work are aged 25-34 (327 people), followed by people aged 35-44 (319 people), i.e. mainly young, employable people are leaving the country.

The year 2019 is marked by a significant wave of migration, a year in which the population, driven by the socio-economic problems caused by the Covid-19 pandemic, chose the foreign route. Thus, a total of 3,660 people emigrated this year (Figure 5),

including 2,463 people aged between 15 and 54, with the largest share of people aged between 15 and 44.

The effects of the Covid-19 pandemic were felt particularly strongly on the living standards of the population, highlighting poverty more and more, leaving more and more people without a stable source of income, as well as without the basic foodstuffs that people in the villages used to grow in their gardens, for the simple reason that the pandemic did not come alone, it was followed by a dry summer that caused significant damage to farmers, literally bringing them to their knees and demonstrating once again their helplessness in the face of the challenges of nature. We would like to support the scholar Elena Timofti's statement that "even if human safety remains the priority, the economic costs of the pandemic are enormous and unprecedented" [11, pp. 113].

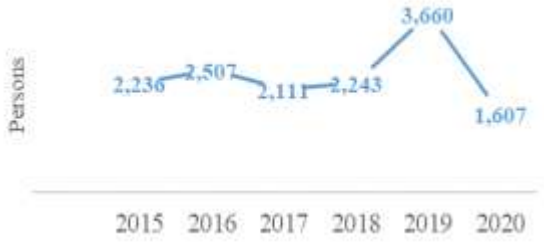


Fig. 5. Number of emigrants from the Republic of Moldova in dynamics for the period 2015-2020, (persons)
Source: Own calculation.

In order, however, to establish the objective level of living of the population in rural areas and to elucidate the reasons for accepting unskilled work abroad at the expense of skilled work at home, we will now analyze the income and expenditure of the population by residence (Figure 6).

Thus, the largest share of income recorded by the rural population in 2020 is accounted for by wage income - 40.5%, followed by income from social benefits - 20.7% and remittances - 16.1%. It is curious, however, that in an agrarian country the share of income from individual agricultural activity is lower than the share of income from remittances, which in 2020 is 15.2%. In this context, we can say with certainty that the rural population earns its living either from wage income or from income from social benefits and remittances, their joint share being 36.8%, which is only 3.7 percentage points below the share of wage income.

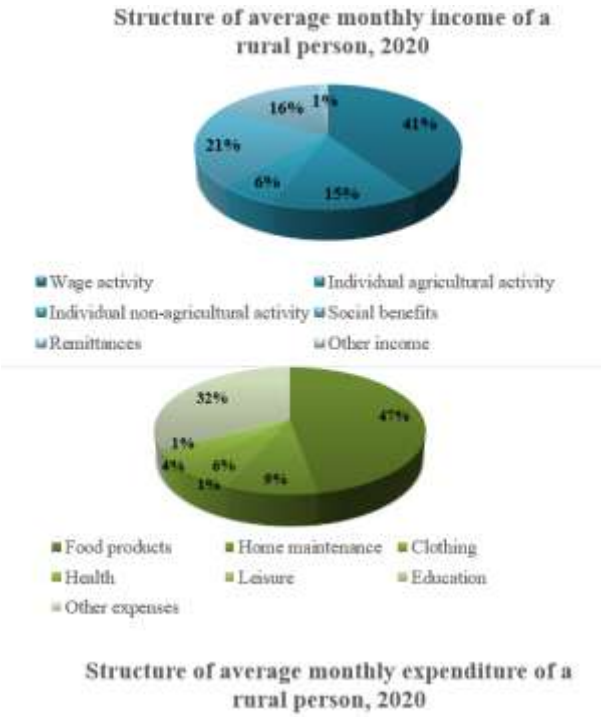


Fig. 6. Structure of average monthly income and expenditure of a rural inhabitant in 2020, %
Source: Own calculation

At the top of the expenditure incurred by rural people in 2020 is obviously expenditure on food - 47.2%, followed by clothing - 9.3% and housing maintenance - 5.7%. Naturally, Maslow's hierarchy of needs theory is still valid. Further proof of the viability and validity of this theory is the fact that for health care, the countryman, having no choice but to make do with what he does not have, spends about 4.1% a year, while for education he spends less than 1%, or 0.5%. We are astonished to see that the rural population spends more money on leisure (1.2%) than on education. The list of curiosities, which we allow ourselves to consider paradoxical, does not end there. If we compare the level of income and expenditure recorded annually by environment, rural and urban, we see a striking discrepancy, regardless of the fact that the rural population exceeds the urban population. Analyzing the figures presented in Figure 7, we see a slight increase in the

dynamics of the population's income in 2020 compared to 2019, but also a significant difference between the level of this indicator in cities and villages. For the year 2020 the income recorded in urban areas exceeds the income in villages by 1,238 lei or 50.38%. Analyzing the income dynamics for the years 2015-2020, we can see a more pronounced increase in the income received in urban areas in 2019 compared to 2018, when the income of the population in cities increased by 25% and that of the population in villages by 6.7%. For people in villages a more significant increase in income was recorded in 2020 compared to 2019, a year in which the income of the rural population increased by 20.16%.

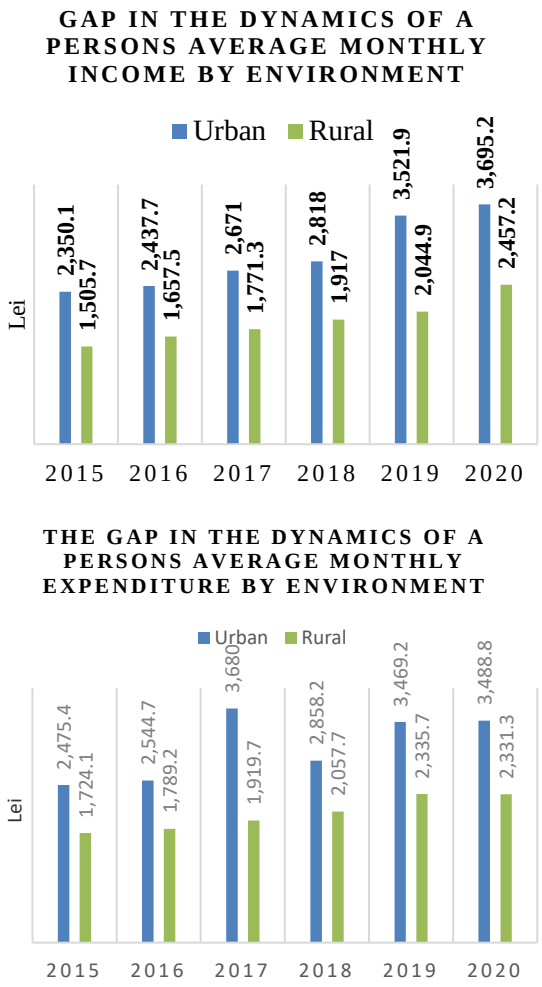


Fig. 7. Dynamics of monthly income and expenditure per inhabitant by residence for the years 2015-2020, lei
Source: Own calculation.

Strangely, the average monthly expenditure of a rural person in 2020 compared to 2019 was reduced by 4.4 lei, which is not significant, but in comparison with the 20% increase in income it raises unintentional questions.

We note, however, that the level of income barely exceeds the level of expenditure incurred in 2020 (by 125.9 lei), and people in the countryside can afford to spend on average 328.5 lei more than the subsistence minimum (2,002.8 lei for 202). The question arises involuntarily: what do people live on in the Republic of Moldova? How does it manage to exist when it can afford nothing more than 328.5 lei? Moreover, looking at the minimum subsistence level for the year 2020, one wonders what a family with 3 children lives on, which according to statistics requires an income of 10,061 lei, if the average maximum salary level in industry is 9,493.1 lei and in agriculture only 6,072.6 lei. And here we should mention that 2020 is the only year in the period analyzed (2015-2020) in which the income of the rural population exceeds expenditure. Again, we assume that these are the effects of the pandemic that has taught the population to live or, rather, to exist with nothing and from nothing, limiting themselves to the consumption of goods and/or depriving themselves of other necessities such as education, culture, health, and this is unacceptable, but nevertheless genuine for the harsh reality that Moldova is facing at the present stage. In this context, we support the statement of the scholar Elena Vaculovschi according to which "the inequality and inequality that persists in the distribution of income remains, for the time being, an unresolved problem that risks becoming a permanent feature of the Moldovan development model" [3, pp. 62].

It is natural that the population of the Republic of Moldova primarily satisfies its physiological needs, but it is curious that in the list of so-called "physiological needs" that the population of our country cannot do without, alcoholic beverages and tobacco are also included. And if the population can limit to the maximum its financial resources invested in education and other necessities, it cannot do without these vices. Statistics show that in 2020 the country's population will invest 3.5 times less in education than it spends on tobacco and alcohol (Table 5).

Table 5. Dynamics of average monthly expenditure per person on alcohol, tobacco and education for the period 2015-2020

| Year | Average monthly expenditure per person on alcohol and tobacco, lei | | Average monthly expenditure per person on education, lei | |
|---|---|---|---|---|
| | Urban | Rural | Urban | Rural |
| 2015 | 31.4 | 26.7 | 18.3 | 9.4 |
| 2016 | 37.6 | 27.1 | 20.7 | 9.7 |
| 2017 | 38.4 | 29.5 | 14.4 | 10.1 |
| 2018 | 41.9 | 35.3 | 17.2 | 7.6 |
| 2019 | 57.0 | 46.0 | 54.9 | 15.9 |
| 2020 | 76.5 | 41.3 | 35.0 | 11.9 |

Source: Own calculation.

If we compare the same indicators in urban versus rural areas, we are astonished to see that the urban population also prefers alcohol and spends twice as much on it. We would point out that expenditure on alcohol and tobacco in rural areas has a positive dynamic, falling only in 2020, presumably as a result of the pandemic, and that investment in education is both increasing and decreasing. In such circumstances, we can only see how right Dimitrie Bolintineanu was when he said that "the country will be what the school is".

It is distressing to see how the authorities are forced to reduce the number of educational institutions which simply become useless for lack of financial resources to invest and, basically, to maintain, for lack of desire to receive a quality education and for lack of pupils (Figure 8).

Thus, in the school year 2020-2021 compared to 2019-2020, the number of primary schools will increase only by 3 units, a situation imposed by the demand to reopen primary schools in some rural localities, as well as by the fact that the number of primary school students has increased by 113 students. The number of secondary and high schools in rural localities is dramatically decreasing in the school year 2020-2021 compared to 2019-2020.

The number of high schools in rural areas has decreased by 10, and the number of secondary schools by 14. The number of pupils attending these institutions is also falling dramatically: for secondary education by 330 pupils and for high school by 2,490 pupils.

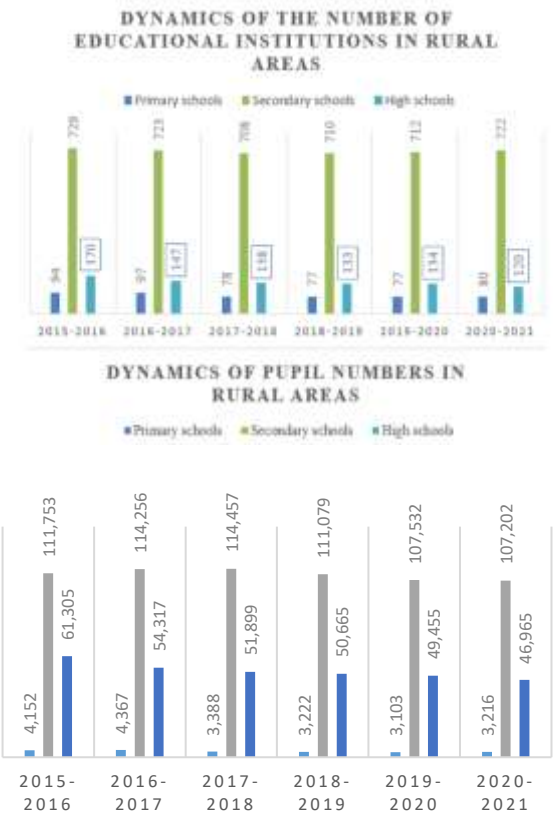


Fig. 8. Dynamics of the number of education institutions and scholars in the rural area for the period of the education years 2015 - 2021
Source: Own calculation.

With no investment in education, we are not surprised that the number of cultural buildings and libraries in both rural and urban areas is falling. Analyzing the number of cultural buildings, we can mention that in the last six years it has been reduced by 10 units in urban areas and by 11 units in rural areas (Table 6), only in 2020 compared to 2019 in rural areas 8 houses of culture were closed.

Table 6. Dynamics of the number of cultural institutions and libraries according to the environment of residence for the period 2015-2020 (number)

| Year | Number of cultural institutions | | Number of libraries | |
|---|---|---|---|---|
| | Urban | Rural | Urban | Rural |
| 2015 | 80 | 1,138 | 158 | 1,195 |
| 2016 | 81 | 1,138 | 155 | 1,188 |
| 2017 | 80 | 1,139 | 154 | 1,184 |
| 2018 | 80 | 1,136 | 155 | 1,179 |
| 2019 | 81 | 1,135 | 156 | 1,170 |
| 2020 | 70 | 1,127 | 154 | 1,165 |

Source: Own calculation.

No less dramatic is the fate of libraries, which in the same six years have been reduced by 4 units in urban areas and by 30 units in rural

areas. And again, 2020 compared to 2019 resulted in the closure of 2 libraries in urban areas and 5 libraries in rural areas, which is a significant loss of the value of culture in a society.

As a result of the Covid-19 pandemic, there has been an increase in the number of health care institutions providing primary and specialized health care (Figure 9), which in 2019 compared to 2018 increased by 26 units. We would like to mention that in 2020 this number has decreased by 2 units compared to 2019, but this cannot be seen as negative simply because the pandemic is subsiding thanks to the fact that a significant number of people have been immunized.

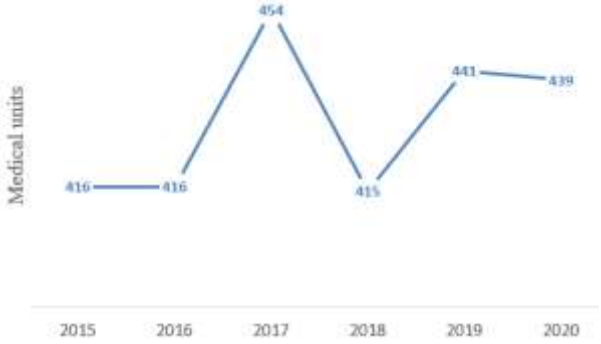


Fig. 9. Dynamics of the number of health care institutions providing primary and specialized care in the period 2015-2020
Source: Own calculation

The pandemic has also made us appreciate more what we have, placing a high value on the quality of our environment.

Thus, in the period 2019-2020, special attention is paid to the planting of forests, the areas covered by them in 2020 making up 381.8 thousand hectares. Unfortunately, however, the planted areas still need to be cared for, and the secular forests - to be rebuilt, a chapter in which there is a negative dynamic. Thus, the areas tended and reconstructed are decreasing, with a negative dynamic of 2.7 hectares in 2020 compared to 2019. But, as mentioned earlier, rural areas are undergoing a process of massive depopulation, in which case particular attention should be paid to forest care by combating unsanctioned and unpunished deforestation or, if it is punished, then with minor fines, which will certainly not eradicate poaching.

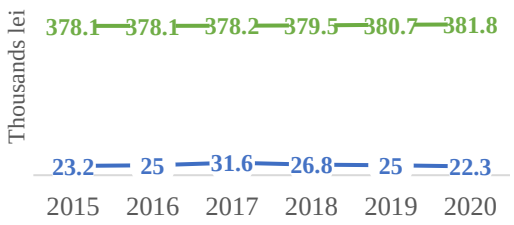


Fig. 10. Comparative dynamics of areas covered by forests and areas tended and restored in the period 2015-2020
Source: Own calculation.

## CONCLUSIONS

Under these circumstances, instead of continuing to publish scathing statistics, to trumpet loudly and clearly on all the TV channels about the desolate situation in which rural localities have found themselves, the need to intervene, as little as possible, with concrete measures for the development of rural areas is even more felt.

"In such a context, it is the state that must protect the countryside from the increasingly powerful and complex aggressions coming from outside, by providing facilities to discourage its depopulation, and the task of sustainable development must fall primarily to local authorities, because the peculiarities of each rural settlement require special visions and different ways of achieving performance in the process of developing rural localities" [9].

On the other hand, there is a "particular intellectual resource, the latent state of which can be changed by identifying local catalysts that would ensure a more active involvement in making the implementation of rural development policy more effective by using all available modalities - experience, promotion, implementation of regional and international best practices, support for capacity building and institutional strengthening.

This particular intellectual resource is the local public authority" [2, pp. 230-231].

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# MUTUAL INSURANCE FUNDS TO REDUCING AGRICULTURAL RISKS- A THEORETICAL APPROACH

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***Abstract***

*Production risk insurance is a mandatory component of any effective management system in all areas of economic activity. In agriculture, where production activities, primarily in crop cultivation, are subject to the influence of uncontrolled natural factors - droughts, hail, heavy rains, hurricanes, abnormal temperature fluctuations, etc., risk insurance remains an objective necessity. The study conducted by the authors in this paper on the level of development of agricultural insurance in the Republic of Moldova highlights the poor development and low interest of farmers in agricultural risk insurance products. The application of statistical analysis tools and content analysis allowed the authors to conclude that the problem of agricultural risk insurance could be solved to some extent by the implementation of the Agriculture Index Insurance method by insurers. At the same time, the association of groups of agricultural producers in the establishment of mutual agricultural insurance companies based on public-private partnership principles would increase the insurance coverage of this sector*

***Key words*****:** *mutual insurance, agriculture, risk, Agriculture Index Insurance*

## INTRODUCTION

Agriculture, by its very nature, is a risky business, as it is often carried out under the open sky, and over the last thirty years, the agricultural sector has been facing increasing risks as a result of the already visible effects of climate change. Unlike other sectors, farmers' incomes are affected by climate-related risks, which are more difficult to manage, and the negative impact affects not only farm performance and wealth (assets) but also food security, the sector's ability to grow, and also the entire supply chain.

In this context, an important role is played by agricultural insurance, in most cases supported by governments through various aid instruments, as insurers do not consider agricultural risk insurance an efficient insurance product.

At the European level, agricultural risk management is constantly changing, conditioned by the agreements concluded with the World Trade Organisation, as well as by the policies of governments that are increasingly withdrawing from providing aid in the event of disasters, epidemics, etc. The experts recommend income insurance as a useful tool for managing farm risks (Kahan, D., 2013 [9]; Pierce, J., 2020 [15]; Severini, S. et al., 2021 [16]). At the same time, this instrument is subject to criticism arguing that income insurance for farmers is problematic. As reasons are cited asymmetry of information and a high probability of risks due to price fluctuations, floods, drought, and animal epidemics. The most eligible forms of insurance include field crop insurance products, especially if there are relevant futures markets and relevant crop productivity databases. Such insurance schemes are also practiced in EU countries, both by private insurers and through subsidy or public-private partnership measures.

In this context, the purpose of the paper is to investigate the agricultural insurance in the Republic of Moldova in the period 2012 - 2021, in the light of the following:

-dynamic development of the number of insurance policies concluded, of the amount insured and the insurance premiums collected by insurance companies for insuring the production risks in agriculture;

-determination of the amount of financial means annually allocated by the State for subsidised production risk insurance;
-dynamic development of compensation paid to producers to cover financial losses caused by agricultural risks and their share in total compensation paid by insurers;
-determination of the insurance object most affected by risk factors during the period under review;
-identifying solutions to increase the insurance coverage of the agricultural sector.

## MATERIALS AND METHODS

For the present study, the authors applied the content analysis method related to agricultural risk insurance, factors motivating insurance in agriculture, and established research on the role of mutual societies in ensuring the financial stability of agricultural farms. The comparative analysis allowed us to highlight the Agriculture Index Insurance method as an insurance tool for small farmers to manage climatic risks. The index developed by MRR Innovation Lab researchers can be used by both commercial and mutual insurers to indemnify the policyholders.
As data sources for the presentation of the current state of agricultural risk insurance in the Republic of Moldova, the reports of the Agency for Intervention and Payments for Agriculture (AIPA), data collected from the Information System "Evidence of Applicants and Beneficiaries of Subsidies" (SIA ESBS) were used.
The statistical processing of the evolution of the mutual insurance sector at the European level was carried out using the least squares method. Comparison, dynamic, and structural indices methods were also applied.

## RESULTS AND DISCUSSIONS

To cover damage caused by natural factors (frost, drought, heavy rains, etc.) farmers contract insurance protection services. In this context, agricultural insurance in most countries is characterized by state participation in insurance programmes, which in turn are a component of state or Community agricultural policy.
Subsidized agricultural insurance through state programmes is also carried out on the insurance market in the Republic of Moldova. Their purpose is to encourage agricultural producers to insure their property interests against risks specific to agricultural activities and to protect these interests in the process of insuring production risks in agriculture (Act no. 183, 2020) [1].
The state subsidisation of the insurance premium is a much more effective instrument than the financial assistance that is granted in bad years in the form of financial aid to cover losses or other forms of aid. At the same time, premium subsidisation for agricultural insurance is seen as an instrument, the application of which does not violate the rules of the World Trade Organisation and can serve as an effective lever to stabilise the income of agricultural producers.

Table 1. The evolution of the financial means allocated by the state for the subsidized agricultural insurance (million MDL)

| Year | Subsidized gross written premiums, million MDL | including for: | | | Increase/ decrease compared to previous year, % |
|---|---|---|---|---|---|
| | | crop | Multiannual plantations | animals | |
| 2012 | 42.7 | 42.0 | 0.2 | 0.5 | - |
| 2013 | 54.5 | 18.2 | 35.4 | 0.85 | 27.6 |
| 2014 | 29.15 | 14.55 | 11.8 | 2.8 | -46.5 |
| 2015 | 21.85 | 190.0 | 1.1 | 1.7 | -25.0 |
| 2016 | 7.49 | 5.62 | 0.79 | 1.07 | -66.0 |
| 2017 | 4.84 | 4.07 | 0.13 | 0.65 | -35.4 |
| 2018 | 5.01 | 3.69 | 0.56 | 0.76 | 3.5 |
| 2019 | 5.1 | 4.03 | 0.25 | 0.82 | 2.0 |
| 2020 | 7.8 | 6.6 | 0.1 | 1.4 | 55.7 |
| 2021 | 45.1 | 35.0 | 2.6 | 7.5 | 478.2 |

Source: Prepared by the authors on the basis of the reports of the National Commission for Financial Markets, 2012-2021 (NCFM, 2021 [14]).

Despite the fact that the subsidisation of agricultural insurance is intended to maintain the financial stability of farms, it has not become popular and attractive to farmers in

Moldova (Table 1). Under the conditions of subsidisation of insurance premiums for farmers from the resources allocated through the National Fund for the Development of Agriculture and the Rural Environment, Submeasure 1.7A, Stimulation of risks insurance mechanism in agriculture, the insurance coverage rate of biological assets (plantations, crops, livestock, poultry, bee families, etc.) is very low.

Agricultural risk insurance is currently not a widely used instrument by agricultural producers in the Republic of Moldova due to the limited funds allocated to Submeasure 1.7A, Stimulation of risks insurance mechanism in agriculture, At the same time, the high costs of insurance services, the difficult financial and economic situation of agricultural producers and other factors prevent the development of another form of insurance relationship, represented by mutual insurance companies. In order to stimulate agricultural insurance as a form of risk management, starting in 2021 the Moldovan government, through the Agricultural Intervention and Payments Agency (AIPA), is subsidising 70% of the insurance premium paid by farmers to insurance companies.

Table 2 presents data on the structure of the areas of agricultural crops insured and subsidised under Submeasure 1.7A, Stimulation of risks insurance mechanism in agriculture.

Table 2. Structure of agricultural crop areas under Submeasure 1.7A in the Republic of Moldova, 2021-2022

| Insured agricultural crops | Year | | Share, % | |
|---|---|---|---|---|
| | 2021 | 2022 | 2021 | 2022 |
| Wheat | 2,730.8 | 3,807.8 | 16.11 | 29.28 |
| Barley/rape | 493.0 | 219.5 | 2.9 | 1.69 |
| Sugar beet | 220.0 | 75.0 | 1.3 | 0.58 |
| Sunflower | 7,499.6 | 3,050.1 | 44.25 | 23.45 |
| Soy | 276.0 | 284.2 | 1.63 | 2.18 |
| Corn | 3,348.0 | 3,450.1 | 19.75 | 26.52 |
| Multiannual plantations | 2,380.6 | 2,119.8 | 14.06 | 16.3 |
| Total | **16,948.0** | **13,006.5** | **100.0** | **100.0** |

Source: data systematized and calculated by the authors based on the Information System "Evidence of Applicants and Beneficiaries of Subsidies (SIA ESBS) ofthe Agency for Intervention and Payments for Agriculture (AIPA) as of 31 December 2022."

An analysis of the crop structure insured under Submeasure 1.7A shows that the largest share goes to cereal and technical crops. In 2022, the insured area under sunflower has doubled, which has also influenced the decrease of the total insured area by 3,948 hectares (Figure 1), although the share of the publicly subsidised insurance premium has increased.

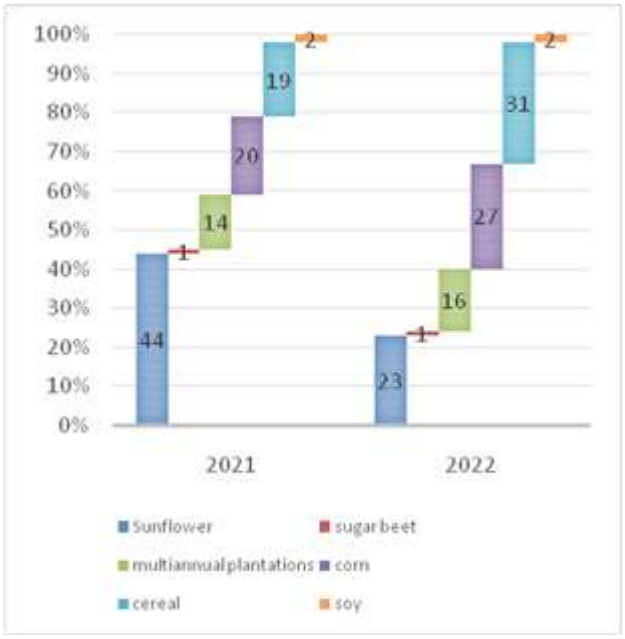


Fig. 1. Structure of areas under insured agricultural crops, %.

Source: data systematized and calculated by the authors based on the Information System "Evidence of Applicants and Beneficiaries of Subsidies (SIA ESBS) of the Agency for Intervention and Payments for Agriculture (AIPA) as of 31 December 2022."

The analysis of subsidised production risk insurance in agriculture for the period 2012-2021 shows a reluctance of farmers to use insurance policies as a production risk management tool. The downward trend in insurance premiums paid by farmers is an eloquent argument in support of this claim (Table 3).

The situation changed in 2021, thanks to legislative changes. In 2020, Law No. 183/2020 [1] on subsidised insurance in agriculture came into force, allowing agricultural producers to pay insurance premiums in instalments and increasing the share of the insurance premium covered by the National Fund for Agriculture and Rural Development from 50% to 70%.

Table 3. Agricultural insurance in Republic of Moldova in 2012-2021

| Year | Total insurance premiums, million MDL | Gross premiums underwritten by agricultural producers, million MDL | Share of gross agricultural premiums in total gross premiums subscribed, % | Insurance claims - total, million MDL | Insurance claims paid to agricultural producers | Share of insurance claims paid to agricultural producers in total, % |
|---|---|---|---|---|---|---|
| 2012 | 1,089.3 | 74.4 | 6.83 | 430.5 | 100.2 | 23.27 |
| 2013 | 1,198.9 | 91.0 | 7.59 | 432.4 | 27.4 | 6.37 |
| 2014 | 1,203.6 | 58.3 | 4.84 | 513.6 | 6.7 | 1.3 |
| 2015 | 1,225.5 | 43.7 | 3.56 | 386.6 | 5.7 | 1.47 |
| 2016 | 1,380.1 | 14.97 | 1.08 | 519.1 | 11.07 | 2.13 |
| 2017 | 1,441.9 | 10.73 | 0.74 | 506.03 | 1.98 | 0.39 |
| 2018 | 1,518.1 | 10.16 | 0.67 | 549.0 | 2,65 | 0.48 |
| 2019 | 1,624.7 | 11.0 | 0.68 | 653.8 | 4.6 | 0.7 |
| 2020 | 1,452.9 | 15.5 | 1.07 | 596.4 | 26.5 | 4.44 |
| 2021 | 1,926.3 | 67.5 | 3.5 | 662.1 | 16.5 | 2.49 |

Source: Prepared by the authors on the basis of the reports of the National Commission for Financial Markets, 2012-2021 (NCFM, 2021 [14]).

This has influenced a sevenfold increase in the number of subsidised production risk insurance policies in agriculture, but not the average amount insured per policy. If in 2012 the average amount insured per policy was 5.11 million MDL, then in 2021 was 1.05 million MDL.

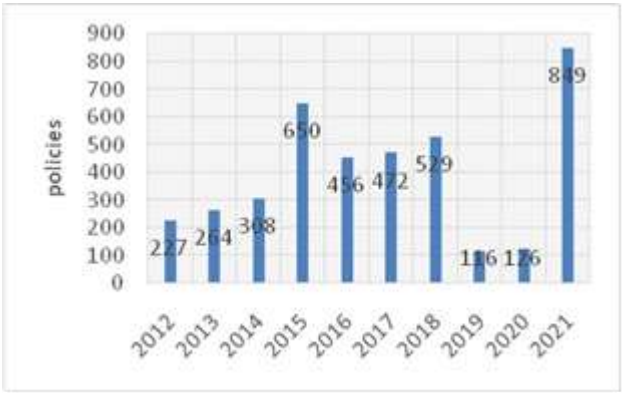


Fig. 2. Subsidized production risk insurance policies in agriculture

Source: Prepared by the authors on the basis of the reports of the National Commission for Financial Markets, 2012-2021 (NCFM, 2021 [14]).

Risk factors such as spring frosts, hail, floods or excessive drought affect crop yields to a large extent. An analysis of the compensation paid by insurance companies to agricultural producers affected by risks shows that in most cases financial losses were covered as a result of a reduction in the quality or a lower than planned crop yields due to the insured risk occurrence. The share of compensation paid for these insurance subject matters is between 82% and 99.8%, with the exception of 2013 and 2014, when half of the compensation was directed towards compensating insured farmers for financial losses in cases of total or partial destruction of multiannual plantations.

In 2022 the value of risks insured through Submeasure 1.7A amounted to 94.3 million lei, which is 26.6 million lei (39.3%) more than in 2021. At the same time, the value of subsidies requested by insurance companies amounted to 66 million lei compared to 47.4 million lei in the previous year.

Yu, J., Smith, A., and Sumner, D.A. analyzed the effects of subsidizing crop insurance premiums on the development of the areas occupied by these crops (Yu, J. et all., 2018) [21]. Crop insurance is the most expensive agricultural policy in the United States, so subsidised crop insurance programs are becoming increasingly popular worldwide in both developed and developing countries (Barnett, B. 2014 [3], Mahul, O., Stutley, C. 2010) [11]. Research conducted on a sample of US farms allowed the authors to find that subsidizing insurance premiums encouraged farmers to increase their crop insurance coverage. The authors also estimated that a 10% increase in the insurance premium subsidy results in a 0.43% increase in crop

acreage if the competing crop insurance premium subsidy is held constant.

The analysis of the number of livestock and poultry insured by farmers in the Republic of Moldova (Figure 3) revealed an 18% increase in the amount of livestock and a decrease in the percentage of insured poultry by about 20%.

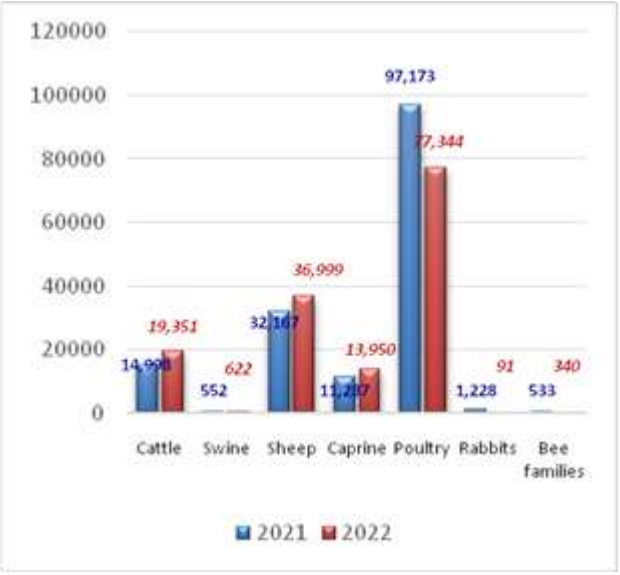


Fig. 3. Livestock and poultry population, and bee families insured under Submeasure 1.7A

Source: Prepared by the authors on the basis of the Information System "Evidence of Applicants and Beneficiaries of Subsidies (SIA ESBS) of the Agency for Intervention and Payments for Agriculture (AIPA) as of 31 December 2022.

In the Republic of Moldova the potential of agricultural insurance is insufficiently exploited. The areas covered by insurance policies vary between 3% and 5%.

In our opinion, one of the significant reasons why agricultural insurance has not yet become an effective instrument for protecting farmers' incomes, is the lack of confidence that insurers will meet their obligations to pay claims. This is explained by the fact that insurance contracts often contain conditions and clauses that leave insurers very wide opportunities to refuse insurance payments. In this case, a solution would be the application of Agriculture Index Insurance, which is recommended as an insurance tool for small farmers to manage climate risks. The index developed by MRR Innovation Lab researchers can be applied to estimate farmers' losses, including those using state-of-the-art remote sensing technologies. This index facilitates both farmers and insurers, increasing the quality of insurance and the confidence of farmers as consumers of insurance services that contracts will protect them. Factors taken into account when estimating losses are average yields, rainfall, etc. "Index insurance is attractive as a risk-management tool in developing countries where the fixed costs of verifying claims for a high number of small farms make conventional insurance too expensive." (BASIS, 2022)[4].

Agricultural production is substantially affected by global weather variations and the Agricultural Insurance Index can increase the effectiveness of crop insurance (Yi, F. et all., 2020)[22].Conventional insurance pays estimated claims individually to each farmer, while Index insurance (right) involves paying the insurance premium to all insured farmers in the region in equal amounts, estimated as an average of their losses (Yu, J. et all., 2018)[21].

Compensation of agricultural producers on the basis of the agricultural insurance index has advantages for strengthening agriculture, acting as a protection tool for periods affected by natural disasters and calamities, epidemics, etc., and as an investment catalyst in years without destructive phenomena for agriculture.

At the same time, insurers also face difficulties in developing insurance products to cover systemic agricultural risks (Skees, J., 1997)[17] that do not burden farmers, while governments often intervene ad hoc in disaster situations with instruments to support farmers, which does not contribute to the development of new agricultural insurance products. As solutions to these challenges, the World Bank recommends that governments support agriculture by implementing other instruments.

One solution would be to associate agricultural producers with mutual insurance companies, which have non-profit status. The work of mutual insurance funds and mutual societies is based on the principles of cooperation, mutual aid, and mutual support.

This form of organizing insurance relations helps to increase the interest of agricultural producers in insurance, reduce the costs of its implementation and solve many problems. Mutual insurance companies are at the basis of the agricultural insurance system in Canada, the USA, Japan, and the EU.

Under Law No 312/2013 on agricultural producer groups and their associations, farmers in the Republic of Moldova could solve the problems of insufficient public funds for subsidized insurance by setting up mutual funds for agricultural risk insurance. In this case, farmers would not be dependent on government policies and priorities and bureaucratic procedures, often invoked by farmers, as well as the cumbersome procedure for recovering compensation from insurers.

Such crop insurance schemes are an agricultural policy tool in both developed and developing countries. However, according to experts, they are fiscally costly for the state and do not have wide coverage, as insurance is only provided within the limits of an insurance fund, to which small farmers do not have much access and which favors large agricultural producers (World Bank, 2008)[20].

The following principles underlie the mutual system(ICMIF, 2020)[5]:

-*Strategically oriented management* aims first at long-term value creation, then at profitability.

-*Customer orientation* requires a model of owner involvement that is different from customer involvement.

-*Value creation* for key stakeholder segments and their peripheral components plays a decisive role in achieving growth and innovation objectives.

-*Social and economic transformation* of local communities and disadvantaged segments is the core objective.

Of particular interest in this respect is the experience of Canada, where insurance of agricultural risks by mutual insurance companies has become widespread. More than 200 years ago, farmers' associations began operating in Canada on the "neighbor helps neighbor" principle. In the 20th century, many of these associations, already legally registered as mutual insurance companies, went through a process of consolidation, resulting in a strong pool in the market: FarmMutualFinancialServices.

Turkey has adopted Spain's Agricultural Insurance Pool model to establish the appropriate agricultural insurance system – TARSİM. "With the application of the pool in Turkey, catastrophic risks such as drought and frost that an insurance company cannot undertake alone can be covered" (Tekin, A. et all., 2017)[18].

In the Netherlands, mutual insurance schemes are being developed to insure risks caused by outbreaks of contagious diseases in certain agricultural crops, poultry and animals (Meuwissen M. et al., 2001)[12].

Unlike mutual societies, mutual stabilization funds, as defined at the European level, are set up on the private initiative of producer groups with the aim of sharing comparable risks at the sector level. Fund resources are used according to predefined rules to mitigate the financial losses of members who have suffered from risk events.

The problem with their operation is the limited nature of the financial sources to cover losses. At the same time, sharing the same risks, there is a likelihood that the activity of all farmers contributing to the fund will be affected. Reinsurance or cooperation with similar funds in other regions would be a solution in these situations. Also, in some EU countries, the capital of mutual insurance funds is supplemented by a public financial contribution.

Mutual insurers are key stakeholders in Europe's social economy, which comprises 2.8 million businesses and organizations, including mutual insurers, and employs 13.6 million people, whose contribution to EU GDP is 8%. This contribution is due to the EU policy of promoting the social economy and creating favorable conditions for mutual insurers and increasing awareness of the role of mutual insurance in the Member States, including Romania. An important role is played by the Association of Mutual Insurers and Cooperative Insurers in Europe (AMICE), which represents the interests of the mutual and cooperative insurance sector in Europe.

According to studies by European researchers, mutual insurance is supported by the Common Agricultural Policy. Meuwissen, M.P. and others have researched the activity of mutual insurance companies in the Netherlands, identifying both privately established companies and companies receiving financial assistance from public funds. These companies insure risks that are not covered by commercial insurers, such as crop and animal disease risks (epidemics) (Meuwissen M. et all., 2013)[13]. Another solution for insuring agricultural risks is smart insurance projects (e.g. insurance schemes based on satellite images). Climate change is increasing the scale and likelihood of extreme weather events (IPCC, 2014)[8], which requires farms to increase their resilience to them.

Vroege, W. and Finger, R. highlight the following advantages of smart insurance: it provides more accurate information, and better, faster and cheaper observations, which can reduce damage assessment costs, delays in claims payments and can reduce information asymmetry. However, the authors note that satellite information does not automatically provide better insurance (Vroege, W., Finger, R., 2020)[19].

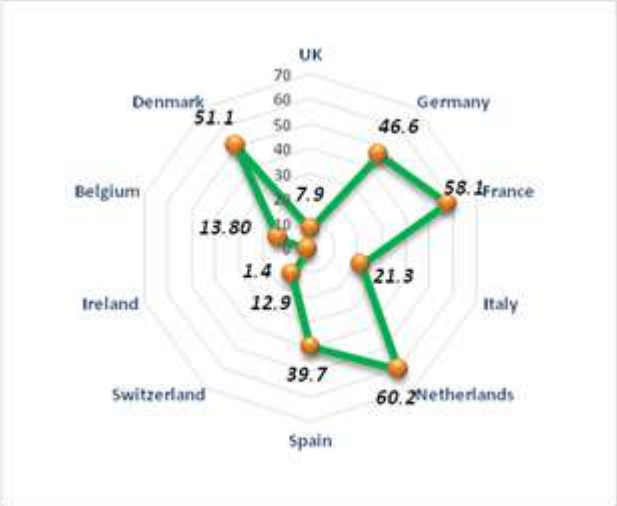


Fig. 4. Market share of mutual insurance in 10 European countries,%
Source: ICMIF, 2022, p.8 [16].

Mutual insurers in Europe have shown great resilience to the challenges of the COVID-19 pandemic. According to data from the International Cooperative and Mutual Insurance Federation, the market share of European mutual life and non-life insurance increased in 2020 compared to 2019. In 2020, mutual insurers experienced a much smaller decrease in total insurance revenues (-1.6%) compared to the significant decrease in insurance premiums across the European insurance market (-6.7%). The European countries with the highest mutual insurance market share are Denmark, the Netherlands, France, and Germany (Figure 4).

Trend analysis for the last decade (2010 - 2020) shows a steady growth of the mutual insurance industry, with a total premium growth of 32.1% over the period, which cumulates in a premium income of €469 billion in 2020. The market share of mutual insurers amounted to 33.4%, representing more than a quarter (25%) of the local market in thirteen European countries.

The development of mutual and cooperative insurance premium income over the period 2011-2020 and its upward trend expressed by a linear model.

The mutual form of organization manifests itself in different forms, depending on the culture and roots of mutuality in the respective country:

-Mutual insurance companies
-Mutual holding companies
-Fraternal/friendly societies
-Groups of insurers and reinsurers
-M&I Associations (Mutual Protection and Indemnity)
-Takaful (Islamic mutual insurance)
-Discretionary mutual societies

One of the mutual forms of insurance is Takaful, often referred to as "Islamic insurance" - a way for companies to mitigate the financial risk of unforeseen events. Takaful is based on solidarity and social cooperation, it is a pact between a group of people who agree to jointly indemnify losses or damages from a fund to which they collectively donate.

The potential of new insurance mechanisms can help increase the resilience of European farms to extreme weather risks. In this context, farmers can apply on-farm risk

management strategies, also called control strategies, or share the risk with others.

Risk control strategies reduce the impact of weather risks. For example, prevention measures, such as the installation of hail protection netting or irrigation equipment, reduce the impact of extreme weather on production, increasing farmers' ability to cope with weather shocks. Risk-sharing helps farmers reduce their exposure to risk. Building up reserves can mitigate the consequences of damage caused by risk. However, these strategies increase production costs (e.g. purchase of an irrigation system).

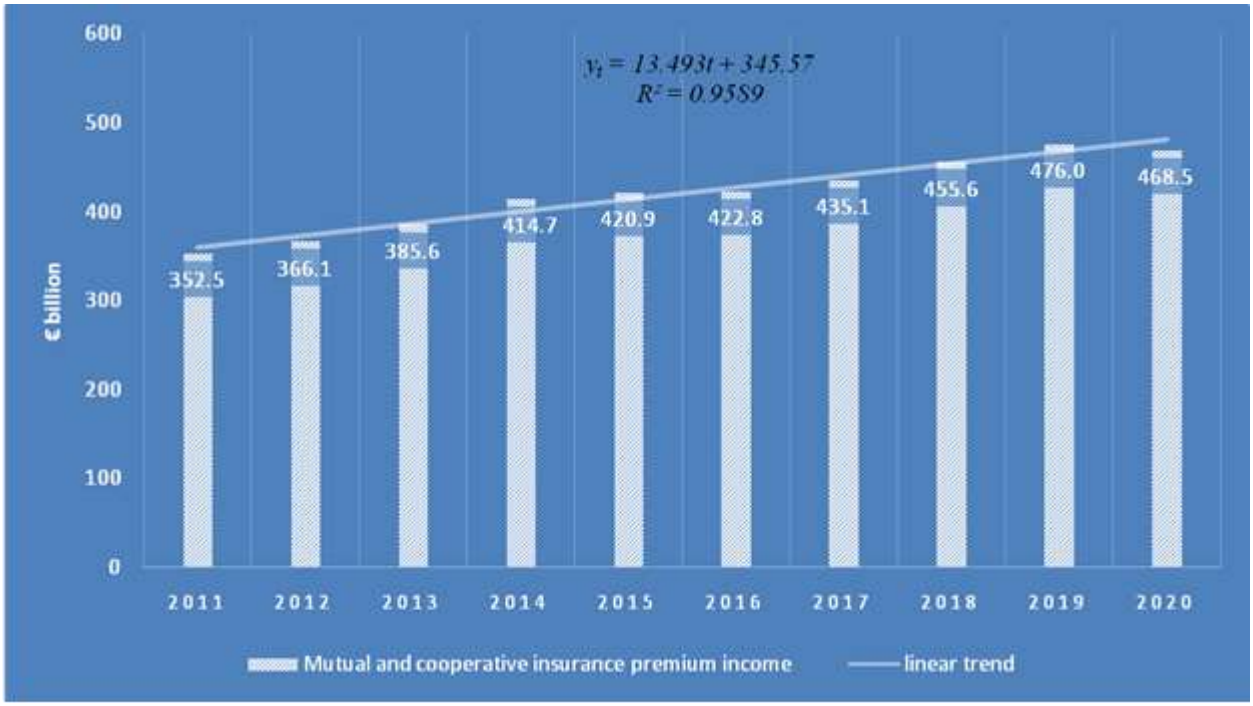


Fig. 5. Evolution and trend of mutual and cooperative insurance premium income at the European level, 2011-2020, € billion

Source: prepared by the author based on data ICMIF [6].

In this way, non-commercial mutual insurance is seen as a more effective form of risk insurance for farmers, which can provide a reliable, accessible, and cheap insurance protection system for businesses, thus contributing to the development of rural communities and the preservation and enhancement of rural employment. For the development of agricultural insurance on mutual principles as an economic and financial mechanism for agricultural risk management, we recommend that the following conditions are met:

-The system of economic relations of a mutual agricultural insurance company is aimed at the establishment and use of insurance funds, the creation of reserve funds as well as other special funds guaranteeing its solvency.

-One of the ways of ensuring the solvency of a mutual insurance undertaking is investment activity. The income from insurance premiums may be used to reduce insurance premiums, to finance preventive measures, to grant short-term loans to members, and for other purposes provided for in the statutes of the society and agreed by its members.

-Reinsurance is an economic instrument for insuring the association's obligations towards its members.

-State support for mutual insurance companies may take the form of subsidization of insurance premiums, allocation of soft loans or grants to top-up insurance funds, and tax facilities.

However, there is a need for greater public sector involvement, through public-private partnerships for reinsurance, which could expand the diversity of income insurance schemes. But there are views that government involvement in subsidized agricultural

insurance should be cautious, as studies show it is fraught with pitfalls. The implementation of income and risk subsidy schemes for farmers could be implemented through pilot measures/experimental trials to determine the attractiveness and effectiveness of income insurance schemes and other income stabilization instruments for stakeholders.

## CONCLUSIONS

The results of the study on the level of development of agricultural insurance in the Republic of Moldova highlight the weak development and low interest of farmers in agricultural risk insurance products.

The purpose of agricultural insurance is to compensate for damage to agriculture caused by natural disasters and other risks. Insurance protection helps to increase the financial stability of farmers and enables them to meet their obligations.

However, the difficult financial and economic situation of most agricultural enterprises, the high cost of insurance services, and the underdevelopment of non-commercial forms of insurance protection in agriculture do not allow insurance to fully manifest itself as a stabilizing and mitigating factor against the consequences of natural disasters in recent years.

Among the factors explaining this situation are the following:

-The difficult financial and economic potential of most farms, which limits their ability to participate in insurance;

-The high cost of commercial insurance services;

-Uncertainty in the interpretation of insurance rules and claims assessment;

-Reluctance on the part of insurers to compensate for losses.

A solution to these problems could be the widespread promotion of mutual insurance protection for agricultural risks.

Its advantages are the provision of insurance services that are comparatively cheaper than commercial insurance, the possibility of accumulating insurance reserves and their subsequent use to cover losses in years with low productivity yields, as well as to finance risk prevention measures, the granting of short-term loans, and the presence of mutual control over compliance with insurance conditions.

For the development of mutual agricultural insurance companies, the following measures are necessary:

-Stimulating through government initiatives the creation and development of agricultural insurance associations and mutual funds by supplementing insurance funds from public funds;

-Encouraging producer groups to form mutual insurance associations with the help of tax incentives.

In our opinion, the presence of mutual societies and funds in the agricultural insurance system will make it possible to solve a number of problems:

(i)The specific insurance needs of agricultural producers will be taken into account to a greater extent, since the rules and conditions of insurance, including insurance premiums and the size of the indemnity, will be determined independently by the members of the mutual society.

No insurance company can offer better insurance conditions than those approved by the policyholders themselves, who are members of a mutual insurance company.

(ii)Reducing the cost of insurance premiums for agricultural producers. Insurance companies do not aim to make a profit, so mutual insurance is cheaper than commercial agricultural insurance.

(iii)Increasing the effectiveness of state aid to farmers.

The insurance funds collected, including those from public funds, will remain at the disposal of policyholders, and it will be possible to direct them in the form of interest-free loans to company members, joint investments, and other purposes.

(iv)Actual compensation of insured losses.

In mutual companies, there is higher reliability of the information on compliance with insurance conditions and the occurrence of insured events based on mutual control.

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# AGRITOURISM IN THE REPUBLIC OF MOLDOVA AND TOURISM PRODUCT COST - A REVIEW

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***Abstract***

*Based on the data of the National Bureau of Statistics of the Republic of Moldova, as well as publications of scholars from different countries, the present paper presents the role of agritourism as a field of activity and as an activity generating additional income and diversifying risks for agricultural entities. The selection of the appropriate method of calculating the cost of the agritourism product has been identified by the authors as an acute problem in the field of agritourism services. The insufficient level of research with respect to the issue of accounting and cost calculation related to the implementation of agritourism activities by agricultural entities, imposes the need to develop and apply some methodological instructions for accounting and cost calculation of agritourism products.*

***Key words*****:** *agritourism, costs, managerial accounting, agritourism product, Travel Cost Method*

## INTRODUCTION

In the Republic of Moldova, agriculture has made a significant contribution to rural development in terms of employment, but also to the formation of the regional gross domestic product for decades. Currently, however, there is a decline in the contribution of agriculture, forestry and fishing to GDP (Figure 1).

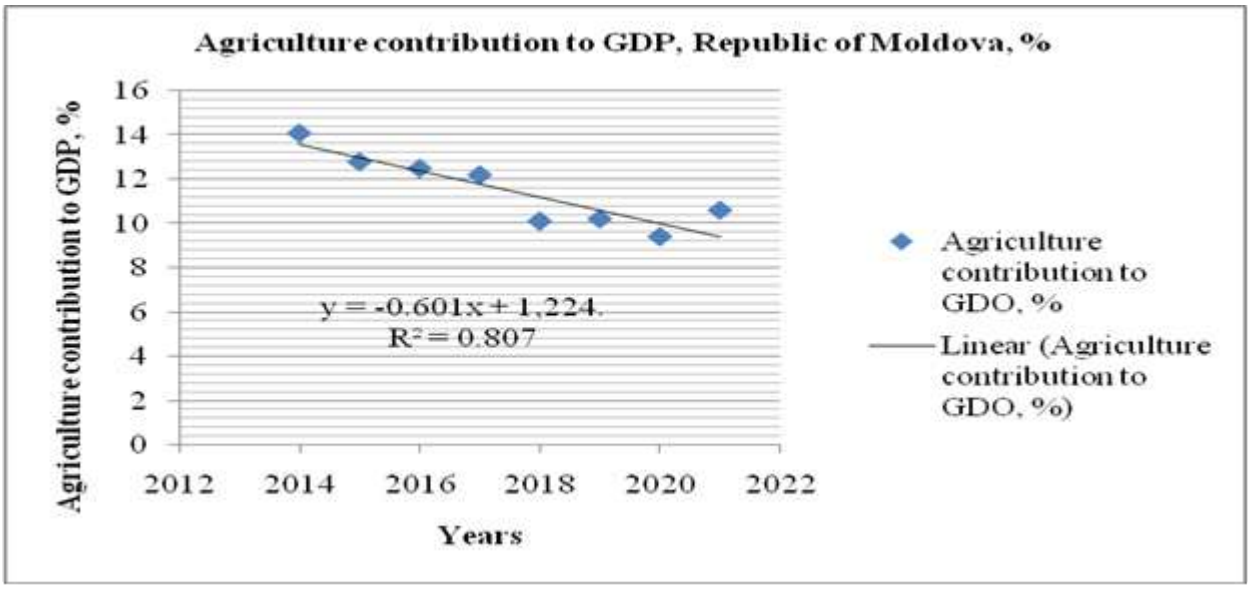


Fig. 1. The share of agriculture, forestry and fishing in GDP during 2014-2021, %
Source: developed by authors based on NBS data [13].

Among the determining factors of the created situation, we can mention:
*-the continuous increase in prices for agricultural inputs*, which favors the disparity of agricultural prices in relation to other fields of activity;
*-cost competition with agricultural producers from other countries*. Thanks to subsidies, farmers from other countries record lower

production costs, which gives them competitive advantages in relation to farmers from the Republic of Moldova.

Within the stated context, farmers from the Republic of Moldova must diversify their activities, in order to reduce the risks specific to agricultural businesses.

These activities would allow them to earn additional income besides the one from agricultural activities. The active promotion of agritourism activities would contribute, to some extent, to the development of the rural economy, which is affected by both, economic and social factors: lack of investment; underdeveloped infrastructure, high rate of migration; negative demographic processes, etc.

Tourism, being one of the industries that is actively involved in the development of the world economy as a service industry, is dependent on the endowment of nature and the cultural heritage of each society. The Republic of Moldova has a relatively small territory, but it has human, natural, landscape potential, as well as folk traditions for the development of agritourism. Agritourism in the Republic of Moldova has a development potential due to the fact that out of the total area of 3,384.7 thousand ha (situation on January 1, 2019), 2,496.4 thousand ha belong to agricultural land, which accounts for 73.76% (National Bureau of Statistics) [13].

There are many studies that address the issue of management, marketing, business organization, etc. in the field of agritourism. At the same time, the authors have found an insufficiency of the research on the accounting aspects of the costs generated by this field of activity.

At first glance, it would seem that it is very simple, but being viewed as an auxiliary activity of the agricultural farm, agritourism activities involve knowledge regarding the accounting of various types of costs, which are not specific to the agricultural branch.

The importance given to agritourism imposes the need for in-depth research into the particularities of the cost accounting related to an agritourism business.

Providing information on the cost of tourism products represents an important function of managerial accounting within an agricultural entity, which also has agritourism as an activity. This information allows managers to identify problem areas, exercise control over production costs and substantiate managerial decisions.

The researches carried out allowed the authors to note the lack of fundamental researches in the accounting of internal and receiving agritourism. In this way, this work comes to contribute, to a certain extent, to the solution of this problem.

## MATERIALS AND METHODS

The informational support of this research is represented by studies of authors from abroad in the field of accounting of costs related to agritourism, as well as the national regulations of the Republic of Moldova in the field of accounting.

For the analysis of some data regarding the dynamic evolution of the number of tourists staying and the number of overnight stays in tourism and agritourism guesthouses in the Republic of Moldova, the authors applied the graphic method of representing the statistical data selected by authors from the databases of the National Bureau of Statistics of the Republic Moldova.

The analysis of conceptual approaches was carried out by the method of comparing different concepts of agritourism, costs related to agritourism, etc.

## RESULTS AND DISCUSSIONS

The benefits of agritourism for the development of rural localities, but also for the development of agricultural farms, are addressed in multiple specialized studies.

The study carried out by Alexis Kate Turnipseed [22] highlights that agritourism brings economic benefits to farmers, landowners and community members. These are presented in Table 1 in a systematized form.

Table 1. Benefits of agritourism to farmers

| | |
|---|---|
| Benefits to Farmers | Agritourism contributes to diversifying the offer of agricultural producers and increasing the demand for products, promoting products and direct sales. At the same time, the business generates additional income not by increasing the cultivated areas, but by increasing the income from providing some services. Therefore, objectives are also pursued to prevent the excessive cultivation of lands, thus contributing to their conservation. |
| Benefits to Agricul-tural Industry | Agritourism contributes to educating the consumer in the spirit of sustainable consumption and the advantages of promoting the local product together with local traditions. Thus, the attitude and support towards sustainable agricultural businesses are strengthened. |
| Benefits to Communi-ties and State Economy | The development of agritourism services offers employment opportunities for the rural population, also contributing to local budgets through breakdowns. These untapped reserves must be promoted as actively as possible, to relaunch small businesses. Currently, only wineries combine agritourism with business in the field. |
| Benefits to the Public | Agritourism offers both, providers and consumers of agritourism services, education for sustainable consumption, education for a responsible management, the chance to experience a way of life in the rural area. |

Source: developed by authors based on Turnipseed, (2022) [22], Schilling (2014) [17], Schilling (2012) [18].

The impact of agritourism on local communities in a society in transition is analyzed by Marko D. Petrović et al. on the example of Serbia [16].

The authors of this study have generalized the impact of agritourism on local communities in two ways: negative and positive. At the same time, the authors highlight the economic, social, cultural and environmental impact (page 149).

Kyungmi Kim [10] in the doctoral thesis research highlighted the major positive and negative impacts of tourism (Table 2).

Table 2. The major positive and negative impacts of tourism

| | IMPACT | |
|---|---|---|
| | POZITIVE | NEGATIVE |
| ECONOMIC | Provides employment opportunities in rural areas.<br>Generates supply of foreign exchange.<br>Increases income and gross national product (GNP).<br>Improves rural infrastructure, facilities and services. | Causes inflation of land value.<br>Raising prices on food and other products.<br>Frequent seasonal employment. |
| SOCIAL | Creates favorable image of the countryside.<br>Provides recreational. facilities for residents, as well as tourists.<br>Facilitates the process of modernization.<br>Provides opportunities for additional education. | Creates resentment and antagonism related to dramatic differences in wealth.<br>Invites moral degradation resulting in increasing crime, prostitution, social conflicts, etc.<br>Causes conflicts in traditional societies and values. |
| CULTURAL | Encourages pride in local arts, crafts and cultural expression.<br>Preserves cultural heritage. | Loss of spiritual and cultural sense due to excessive global commercialization of products.<br>Abandonment of indigenous culture and adapting to modern, generally accepted parameters. |
| ENVIRON-MENTAL | Justifies environmental protection and improvement.<br>Encourages education on value of nature-based tourism. | Fosters water and air pollution and solid waste.<br>Disrupts flora and fauna species |

Source: Kim, K. (2002), pag. 38. [9].

Some studies highlight the long-term impact of agritourism, which is still insufficiently studied as mentioned Stanciu M. et al. (2022), [20], Nicolova M. and Pavlov (2021) [15]. Thus, Sumin Kim et al. support the hypothesis that the agritourism experience significantly alters consumer spending patterns in the food categories of grains, vegetables, fruits, meat and fish (Kim et al., 2002) [9].

Schilling, B. J. (2012) [18] reviews the context of the growth rate of agritourism in the US. The researchers have systematized only the positive impact of agritourism on: farmers; visitors to the farms and communities where they are located. There are also studies that demonstrate that the

demand for rural tourism and agritourism is also dependent on the characteristics of the landscape associated with agricultural activities.

In the correct establishment of the costs related to agritourism activities, an important role belongs to the clarification of the concept, in order to identify the related costs. Agritourism is a form of tourism that takes place in the rural area, capitalizing on local tourism resources (natural, cultural, human) such as tourism facilities and equipment, including guesthouses and agritourism farms or local gastronomic points [20].

As the economist Ceaușu Felicia (2011) [1] mentions, agritourism represents „the form of tourism, practiced in the rural environment, based on the provision, within the peasant household, of the following services: accommodation, meals, leisure and others. Unlike rural tourism, agritourism involves: accommodation in a peasant household (guesthouse, etc.); consumption of agricultural products from the respective household; participation to a greater or lesser extent in specific agricultural activities" (Ceasu, F., 2011) [1].

Agritourism, unlike rural tourism, does not involve the practice of all tourism activities that take place in the rural area. It is closely connected with the life of the rural household, as the agri-guesthouse is the main tourism attraction. Agritourism, being mostly addressed to individual tourists, families or small groups, „... does not need a developed accommodation and food base, it can successfully develop using the existing housing of rural households, as well as recreational spaces within the individual household"(Miron V et al., 2015) [12].

We conclude that the concept of agritourism has multiple definitions, but not all of them reflect its specificity, and some even contradict it. Therefore, in this study, agritourism is defined by the authors as a specific type of tourism, which involves temporary trips (tours) of citizens from the Republic of Moldova and outside the Republic of Moldova from their permanent place of residence in the rural environment (including abroad the country of residence) for health, educational, professional, business, religious and other purposes without engaging in income-generating activities at the place of temporary residence (accommodation).

At the same time, we note that an agritourism business operates on a specialized market - the agritourism market, which should be understood as a system of relations between producers of agritourism services and agricultural products, on the one hand, and consumers of an agritourism product, on the other hand, by establishing a system of intermediate prices (transfer prices) and final prices.

Agritourism services present certain particularities, as they are the result of the activities of an economic entity (limited liability company, joint stock company, etc.) or of a household, farm, carried out on the agritourism market, that aims at satisfying the needs of a tourist in the organization and realization of a tour or some of its components.

In this context, we can delimit the services of the agritourism activity into: *main* (food, accommodation) and *additional*. The additional ones, in turn, can be: *general*, meaning services specific to the tourism market and, *specialized*, which are characteristic only for the agritourism market (for example, visiting the fields of lavender, collecting strawberries and other berries; collecting grapes and fruits (cherries, sour cherries), fishing, etc.). Nowadays, the agricultural sector of the Republic of Moldova can provide a diversified range of organic food products, and by practicing agritourism, farmers can make better use of the agricultural products obtained in their households. We would like to mention that the information provided by the National Bureau of Statistics of the Republic of Moldova is not presented separately for agritourism - but jointly for tourism and agritourism guesthouses.

The data in figure 2 indicate a general trend of increasing indicators, which characterize the situation in the field of rural tourism and agritourism in the Republic of Moldova in the recent years, except for the years 2019-2020, when as a result of the consequences of the coronavirus pandemic (COVID-19), the

number of tourists staying in tourism and agritourism guesthouses in the Republic of Moldova decreased.

Only a few agri-guesthouses from the Republic of Moldova have been included in the international tourism circuit: Eco Resort „Butuceni", „Casa din luncă"guesthouse, „Hanul lui Hanganu" guesthouse, "Casa verde" guesthouse, „Vila roz" guesthouse, „Fata Morgana" guesthouse.

The activity of tourism entities, represented by tour operators and travel agencies, consists in the formation, promotion and sale of a tourism product. Economists G. Stănciulescu and G. Ţigu (1999) [21] define the tourism product as „the set of material goods and services able to satisfy the tourism needs of a person between the moment of departure and the moment of arrival at the place of departure".

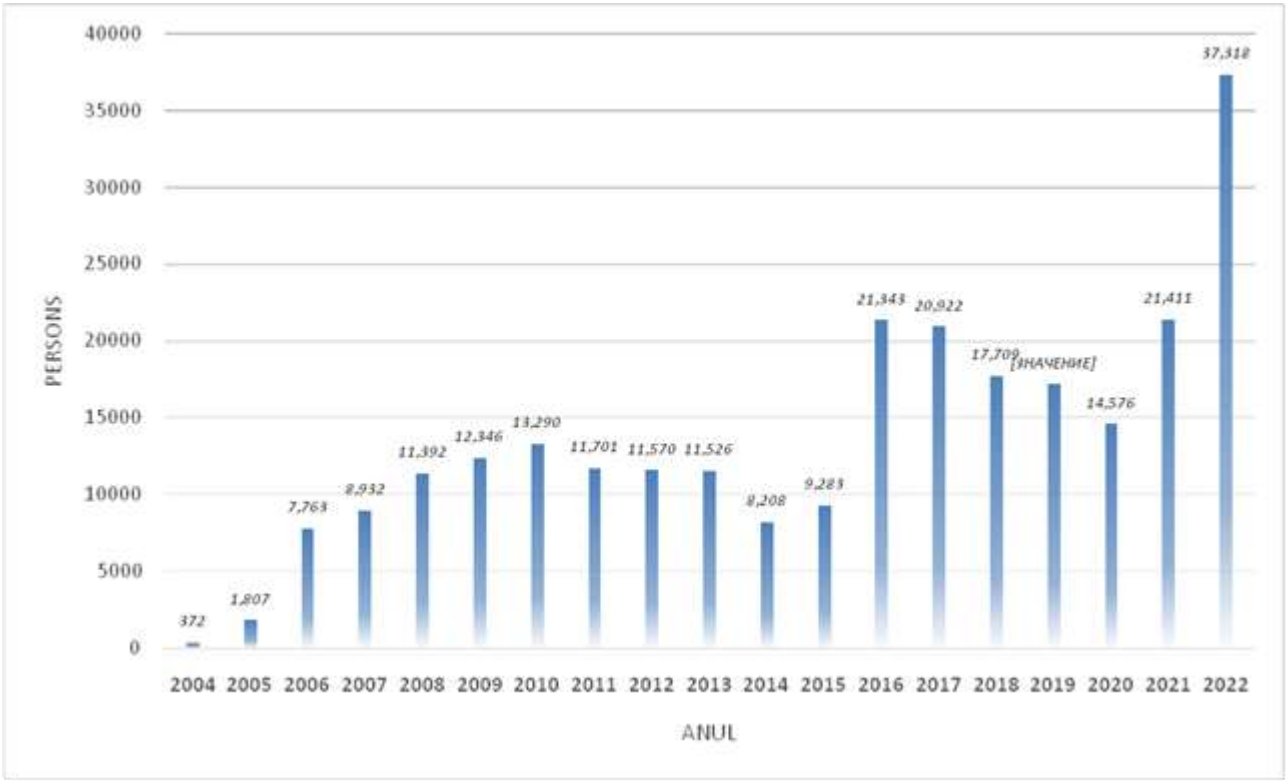


Fig. 2. The dynamics of the number of tourist stays and the number of overnight stays in tourism and agritourism guesthouses in the Republic of Moldova, 2004-2022
Source: developed by authors based on NBS data [13].

The Civil Code of the Republic of Moldova No. 1107 of 06.06.2002, with subsequent amendments in force from 01.03.2019, defines the notion of a *package of travel services (package)* in the sense of a tourism product, which represents a combination of at least two types of different travel services intended for the same trip or holiday [2]. Defining the tourism product concept is important for determining the composition of costs.

For the effective carrying out of the tourism activity, including agritourism, truthful information about the composition of the costs of a tourism product is necessary, and as a result, the correct calculation of the cost of the tourism product. The research carried out by the authors allowed us to find that, currently, tourism entities, including agritourism ones, have a problem related to the lack of information on the costs that serve as a basis for determining the cost of the tourism product, and as a result, for the erroneous assessment of the financial situation of the agritourism entity. The situation is also complicated by the fact that, currently, there is a lack of branch methodical instruction regarding cost accounting and the calculation of the cost of the tourism product in the tourism activity.

Thus, in the authors' opinion, one of the solutions to the problems of accounting for production costs and calculating the cost of the tourism product can be the elaboration and approval in the manner established by the legislation of the Methodical instruction regarding the accounting of production costs and calculation of the cost of tourism products, taking into account their particularities based on the *Guide regarding the accounting of production costs and calculation of the cost of products and services* (Guide, 2013) [7] and comments regarding the application of the provisions of the National Accounting Standards (NAS, 2013) [14] for the tourism activity.

To calculate the cost of a tourism product, it is very important to correctly set the calculation objects. Calculation objects or the so-called cost carriers are presented as a type of product, the cost of which must be calculated. For example, in the case of a group tour, the cost of serving the group of tourists comes up as the object of calculation, while in the case of an individual tour - the cost of serving a single tourist.

Cost accounting is conditioned by the method of calculating the cost of manufactured products or provided services. In most cases, the accounting of production costs for the production of a tourism product is organized according to the order method, where the object of calculation is a separate order for the production of a certain tourism product or a group of typical tourism products. Sometimes, the cumulation of orders for tourism products, which can be cumulated according to certain characteristics (geographical direction, season, etc.) can act as an object of calculation. The mandatory condition for applying the order method for calculating the cost of a tourism product is the opening of orders. After opening the order for a type of a tourism product, all primary documentation must be drawn up with the mandatory indication of the order code. At the end of the order fulfillment, the order is closed.

Further, we will approach a traditional way of grouping and assigning production costs to the unit cost of the tourism product (package). Thus, the price of a tourism product (package) is influenced by the number of included services: some tourists are offered to choose from a range of services or they are offered a package with the whole set of services included (all inclusive). In the category of basic tourism services, according to the national tourism legislation of the Republic of Moldova, are included the following (Law 352/2007) [11]: transport, accommodation, food, excursions and leisure services. These tourism services are registered within the tourism entity as direct or apportionable costs.

An important cost element is represented by transport services: „tourism transport, in most of cases, is used for the travel of tourists in space in order to satisfy the needs related to the tourism stay, being, as a rule, a basic component alongside accommodation, food, excursions and leisure within the tourism product"(Durovich A., 2005) [4].

As a rule, transport has a considerable weight in the price structure of the tourism product. Depending on the duration of the tour, the distance and the means of transport used, the weight of transport varies from 20% to 60% of the total cost of the tourism package. At the same time, sometimes, tourism packages may not include the price of transporting tourists to and from the destination. In some situations, tourists prefer a more sustainable transport – the bicycle. If we refer to agritourism, in most cases tourists prefer to travel with their own means of transport, for this reason its share in the cost of the agritourism product is insignificant. Thus, the *"Transport costs"* calculation item includes the cost of travel to the host country (air travel, rail travel, bus, sea ship, etc.), the transportation of tourists from the place of departure to the airport, from the airport to the hotel or to another place of residence, transportation costs for excursion services in the case of bus tours, etc. Only those costs that are mandatory in the tour program are included here.

Depending on the type of transport used to transport tourists, the price of a tourism product changes. Usually, a package of tourism services is calculated for a group of tourists, but there are also individual tours. The number of tourists in a group tour plays an important role, as the more people

participate in the trip, the cheaper the tour cost for one tourist is.

Accommodation represents the next stage after transport, in the organization and development of the tourism service. Accommodation is part of the hospitality industry, which provides the necessary comfort to tourists during their travels. In the case of agritourism, tourists are accommodated in peasant households, tourist guesthouses, etc. Accommodation services aim, through its content, to create the conditions and comfort for tourist accommodation and recreation. The volume, structure and quality of accommodation services depend on the type of accommodation units, such as: hotels, motels, villas, tourism and agritourism guesthouses, rest houses, tourism stops, etc.

In many accommodation units, activities providing cultural-artistic and leisure services are organized. The organization and carrying out of such activities suppose the existence of adequate facilities for spending time and recreation of tourists: swimming pools, saunas, gyms, sports fields, etc., as well as staff trained to guide tourists. Some agritourism guesthouses provide conditions for cultural-artistic events, such as folklore festivals, meetings, meetings with personalities of art and culture, shows, exhibitions and others.

The *„Accommodation costs”* calculation item is calculated based on the room rental price, which depends on the hotel class, the season of arrival, the number of people, the number of nights of stay, etc. As accommodation units can serve: hotels, motels, guesthouses, cabins, villas, campsites, etc.

In the context of the development of tourism services, an important place belongs to tourism food services. The close dependence between public catering and tourism activity is highlighted by their association in a sector called the hospitality industry. Thus, the economist Shmatko (2005) [19] defines the hospitality industry as „a set of activities that involves sheltering and providing food to people outside the area of permanent residence”.

Within agritourism, the agritourism guesthouse can be placed in citizens' homes or in independent buildings and provides in specially designed spaces both, accommodation for tourists, conditions for preparing and serving meals, as well as the possibility of participating in household, craft, cultural and relaxation activities. The agritourism meal is based on traditional cuisine and the products are natural, mainly from the household's own production or from authorized producers in the region. The important thing is that the accommodation prices at agritourism guesthouses are lower than those practiced in hotels. In the Republic of Moldova, agritourism guesthouses can be of the following categories: 1, 2 and 3 stars. In most cases, the accommodation and meal services in agritourism are provided by members of a family (the farmer's family). In the case of an agritourism guesthouse with an accommodation capacity of 5 rooms and more, additional staff is required.

The *„Food costs”* calculation item is calculated according to the tourism type. In most cases, breakfast is included in the price of accommodation services. In some cases, however, breakfast, lunch and dinner are paid separately from the price of accommodation services.

Travelers need someone to accompany them in unfamiliar places, provide them with information and introduce them to the points of interest in the tourism destination. The excursion for tourists, as presented in the specialized literature, represents a moment of intellectual satisfaction, and for the guide is seen as a very complex creative process (Dolzhenko G., 2008) [3]. In the case of agritourism, these services may include accompanying and guiding services on certain scenic routes, initiation into traditional crafts, attendance at some activities, which refer to traditional customs of the household, locality or area.

The *„Costs for excursions”* calculation item includes only those costs for excursions that are provided for in the mandatory tour schedule. Usually these are 2-3 excursions, and it is indicated that, if desired, a tourist can pay for additional excursions on the spot.

These services, as a rule, do not require large investments, but they are well appreciated by tourists due to the active spending of free time, which increases the degree of satisfaction after consuming these services.

Recreational services in agritourism represent the forms of active rest, which are offered by agritourism guesthouses, which take place in nature or in properly designed spaces, in order to restore physical and mental tone. Ensuring a good quality tourism product in agritourism can only be conceived in the conditions where the leisure was thought and designed by the organizers, as an integral part of the tourism stay. Leisure, in the view of local scholars Glavan, V., Rusu, V., and Platon, N. (2004) [6], represents „the set of means, equipment, events and activities offered by accommodation units or tour-operating tourism agencies, in localities, resorts or tourism areas, able to provide tourists with a state of good mood, pleasure or relaxation, to leave a good impression and memory". Depending on the natural, cultural and folklore environment of the region, as forms of leisure offered by peasant households or other categories of entities that can be practiced in agritourism are the following: hiking and outdoor activities; sport hunting and fishing; water sports on local rivers and lakes; horse riding and carriage ride; harvesting the fruit in rural areas; cultural and entertainment activities organized by the artistic collectives of the visited tourism region; making crafts together with folk craftsmen, etc. Activities such as walking, nature watching, camping, barbecuing, etc. could not be organized without the farm's land and ecosystem.

Natural areas are often the focus of leisure trips (e.g. parks, gardens, lakes, agricultural lands, etc.), but the valorization of their services in tourism services is not evaluated. In this context, nature-based tourism is not only a socio-economic activity that brings income and other benefits to local communities, but also plays an important role in understanding natural heritage, obtaining public support and funding for preservation. Some researchers associate tourism with leisure activities that take place in natural areas, and its main components are visitors and experiences in nature (Fredman, P., et al., 2010) [5]. These experiences can be different and include a variety of outdoor activities.

The funds to be allocated for the development of natural resources can be estimated more realistically if their economic value is determined first. As a consequence, some methods have been developed to determine the economic value of natural resource functions that currently have no market value.

The contribution of natural resources is not taken into account when evaluating gross domestic product (GDP). Thus, forest ecosystem services, such as carbon sequestration and air filtration are not valued, considering that many of the benefits that natural capital provides are "free" and can be ignored in the pursuit of economic growth. This assumption leads to irreversible losses as natural capital stocks disappear or diminish. Due to insufficient attention from institutional and political structures, the health of ecosystems around the world is deteriorating and together with it, their capacity to support well-being and sustainable economic growth decreases.

Traditionally, the value or contribution of natural capital is not considered in the decision-making process, even at the business level. Even when considered, decisions are limited to moral arguments or based on an incomplete understanding of organizational relationships with natural capital. Meanwhile, accounting will enable the collection and systematization of information on stocks and flows of natural resources and their evolution over time. In this context, accounting is an important foundation that helps to better manage natural capital both, for the agricultural enterprise itself, as well as a resource for humanity. The global community recognizes that natural capital accounting should be the basis for social and economic decision-making, as well as potentially help avoid environmental degradation and associated economic crises in the future.

In managing an agritourism business, the travel cost method would be useful to assess the benefits of ecosystem services, such as outdoor recreation.

The travel cost method uses willingness to pay approaches relevant for estimation of the economic value of a leisure property. Willingness to pay is reflected by the travel costs, time costs and visit-related expenses incurred by individuals to visit a recreation site. The Travel Cost Method (TCM) is considered as one of the most suitable methods for evaluating the leisure and tourism functions of farms. The main stated advantage is that it is based on human observations. TCM is considered the oldest method of environmental resource valuation and is based on the assumption that a part of the travel costs in the area is the value of the area. Thus, the more tourists will appreciate the agritourism area (for example: Orheiul Vechi), the more tourists will be willing to pay a higher cost.

In addition to the cost elements described above, there may be other cost elements, namely: medical care, treatment for disease prevention purposes, document completion, recreational activities, insurance services during the stay, etc. Thus, the nomenclature, composition and method of cost accounting, calculation items, period and methods of calculating the cost of tourism products are established in the accounting policies of the entity, which carries out agritourism activities.

In addition to the direct or apportionable costs in the tourism activity, indirect production costs are also recorded, which include costs related to the service and management of agritourism activities, which cannot be directly attributed to the cost of the agritourism product and are apportioned according to the basis of selected distribution. The analysis of the practice of some tourism entities allows us to reveal the following nomenclature of indirect production costs related to agritourism services: costs for organizing a tourism group; costs regarding the repair and maintenance of fixed assets intended for the provision of tourism services; amortization of fixed assets and intangible assets intended for the provision of tourism services; the wear and tear of low-value and short-lived objects intended for the provision of tourism services; remunerations calculated for the administrative and service staff of the subdivisions providing tourism services; costs related to delegation, staff training, etc.

The cost of the tourism product (package) represents one of the main economic indicators of the agritourism activity. The choice of the calculation method implies the establishment of the goal pursued with the help of calculation. If we intend to know only the level, in actual sizes, to be able to determine the cost of tourism products, necessary in determining the financial results in financial accounting, we can rely on the traditional methods of calculating costs, namely the order method. If we set the goal of cost leadership, then we must resort to a method that operates with predetermined levels, which establishes deviations in the process of the actual course of activity.

The study carried out on the cost of tourism products showed that it is necessary to modify the calculation method which, at present, does not correspond to the requirements of management accounting, namely: the insufficient use of information on the costs necessary for making managerial decisions, the incorrect calculation of the cost of tourism products, problems in determining the influence of each factor on the cost level of tourism products, etc.

Various methods of calculating the cost of manufactured products or services are presented in the specialized literature, which are grouped according to various classification criteria (Horngren, H., 2007) [8]. After the fullness of production costs included in the cost of manufactured products or provided services, cost calculation methods are divided into calculation *methods of full "absorption-costing" costs* and *partial "direct-costing" costs.*

The *"direct-costing"* method allows us to delimit production costs that vary directly with the volume of production and costs that are maintained at a constant level, regardless of this volume. Thus, deviations in production volume, price, cost and product capacity are tracked, providing a relatively clear picture of the efficiency of the economic entity's operations. The given method gives the possibility to know whether the sales volume is sufficient to cover the fixed production

costs. Thus, only variable production costs form the cost of manufactured products or provided services, since only these are considered to be caused by the production of products or the provision of services.

The survey carried out among tourism entities, including agritourism entities from the Republic of Moldova, demonstrates that these entities use the full cost method when making managerial decisions. Partial costs are very rarely used in the decision-making process, because the way of keeping cost accounting in most tourism entities is not able to provide this type of information, conditioned by the limited knowledge of specialists, as well as the non-use of cost information for making managerial decisions. Accounting, at these tourism entities, processes financial information in accordance with general accounting principles, without tracking and separating variable and constant production costs, which would allow to determine more clearly the production costs directly related to specific tourism products.

According to the *full cost calculation method*, the cost of tourism products includes all production costs incurred during a management period. This allows us to have a vision of all the production costs borne by the entity when forming a tourism product; however, the given method does not take into account an important circumstance, namely the change in the cost of a tourism product in relation to the volume of sales of tourism products. In this context, if a tourism entity increases the volume of sales of tourism products, then the cost of a tourism product decreases, and conversely, if a tourism entity reduces the volume of sales of tourism products, then the cost of a tourism product increases.

It should be noted that, in practice, the entities do not apply pure cost calculation methods, but a mix of methods is observed in relation to various criteria, establishing a relationship of subordination to each other depending on the priority goal pursued by the entity. Thus, the entities that carry out agritourism activities can use the *order calculation method* for the purpose of controlling and analyzing the cost of products, and for making managerial decisions - the *"direct-costing" method of partial costs.*

## CONCLUSIONS

Calculation of the cost of tourism products is important and no one can dispute this. However, determining the cost of tourism products should not be the ultimate goal of the accountant. Under the double effect of the increase in the pressure of competition and the growth in the number of tourism products, the agricultural entities that carry out agritourism activities feel the need to know better the cost of tourism products in order to establish the sales prices and the achievable margins for each tourism product. Knowing these data is necessary for making appropriate decisions and following their implementation.

Agritourism is an opportunity for agricultural farms from the Republic of Moldova to diversify their activities and the risks they are exposed to, by generating additional income. In addition to those mentioned, agritourism is necessary for the multifunctional and sustainable development of peasant (farmer) households, contributing to the preservation of the rural landscape and the biodiversity of agricultural ecosystems.

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# EUROPEAN STRUCTURAL FUNDS IN ROMANIA: ABSORPTION AND IMPACT ON THE AGRICULTURAL SECTOR

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***Abstract***

*The paper proposes an analysis of the effective rate of absorption of European Structural Funds in Romania, allocated to the national agricultural sector, in the period 2019-2022.The research was carried out on the basis of the official information, provided by the Romanian and European statistical systems. National Institute of Statistics and the Ministry of Agriculture and Rural Development. The results of the research show a strong correlation between the effective absorption rate of the European Structural Funds and the total net investments in the agricultural sector at the national level. Agriculture can be considered as a model for the other domestic economic sectors from the perspective of the degree of absorption of European funds. Considering the importance of the agricultural sector, it is necessary that the value of net investments increases, regardless of the source of financing used, but above all that farmers make the most of the opportunity to access non-reimbursable structural funds.*

***Key words*****:** *European Structural Funds, agriculture, absorption rate, investments, Romania*

## INTRODUCTION

Structural Funds, as a set of funds from the European Union (EU), have been accessed in Romania since 2007, after the country's accession to the EU. According to European Commission reports, Romania received approximately 19 billion euros during the period 2007-2013, and around 30 billion euros were accessed during the period 2014-2020 (European Commission EC, 2022) [3]. The absorption rate of European funds in Romania has been very low, and this situation has been done by several factors, including limited administrative capacity.

EU countries and the EC jointly manage these structural funds, including in the agricultural sector, focusing on addressing specific challenges faced by rural areas of the EU. All rural development programs aim to stimulate agriculture development and promote competitive management in the agricultural sector (Massot and Nègre, 2020) [6].

In the Romanian agricultural sector, the National Rural Development Program (PNDR) is dedicated to improve the infrastructure and economic development of rural areas. The Agency for Rural Investment Financing (AFIR) manages, allocates funds, and is monitoring the implementation of the PNDR projects. Funds allocated are designated to increase the competitiveness of agriculture, to improve the economic performance of farms, to develop the irrigation infrastructure, as well to improve the quality and safety of agricultural products, encouraging the implementation of sustainable agricultural practices, and protecting the environment (Ministry of Agriculture and Rural Development MADR, 2022) [7].

Through programs aimed at the agricultural sector, funds have been obtained to support a multitude of projects and initiatives that have led, since the first access, to improving the competitiveness, sustainability, and modernization of the agricultural sector and sustainable rural development (Dinu et al., 2020) [2].

In Romania, the absorption of European funds in the agricultural sector is a subject of interest, both in the economic and agricultural fields. Structural funds represent an important development instrument, but there are a lot of factors that influences the degree of absorption, such as the complexity of

procedures to access it, management and implementation of the projects, as well the available human resources and their expertise (Lupu, 2020) [4].

The effective absorption rate of European funds represents the proportion between the European funds allocated for a particular program or project and the sums actually spent on them in a given period of time, and is a challenge for the Member State (Marcu et al., 2020) [5].

In Romania, the effective absorption rate for 2014-2020 period was low, a consequence of internal factors such as political instability, including in the ministries involved in managing European funds, frequent changes in legislation, and even problems in Romania's information systems (Anghelache et al., 2019) [1].

Even from earlier research, negative influencing factors in the absorption of European funds have been observed, such as the lack of communication and coordination of state institutions, low administrative capacity, and even the way funds are allocated, factors that are still relevant even after nearly a decade of accessing funds (Popescu, 2015) [11].

According to Sima (2022) [12], during the period of 2014-2020, beneficiaries of PNDR have capitalized on the progress and experience gained during previous implementations, while also being in line with the demands made by the EU, as evidenced by the high absorption rate of the program at the end of 2022.

In 2022, the Romanian agricultural sector suffered a real setback due to both the existing climatic and geopolitical and economic conditions at the global level.

For the next period, the National Strategic Plan foresees the increase in competitiveness of farmers in Romania in order to achieve food security, and this objective can only be achieved through investments using all possible and existing sources of financing (Zlatiet all., 2023) [13].

In this context, the purpose of the paper is to analyze the effective rate of absorption of European Structural Funds in Romania, allocated to the national agricultural sector, in the period 2019-2022.

## MATERIALS AND METHODS

The notions regarding general and descriptive data about theoretical and technical information were selected from the specialized websites of: the MADR, Ministry of European Investments and Projects and Agency for the Financing of Rural Investments. For documentation, scientific information provided by Clarivate, SCOPUS, Research Gate and Google Scholar were used. For scientific research, data provided by National Institute of Statistics NIS (Tempo Online database) and Ministry of European Investments and Projects (MIPE) have been selected, processed, and analysed.

The results will be applied in the doctoral research. The analysis could be useful to the management systems of public or private entities in the Romanian agriculture, in order to use the information on promoting, developing and maintaining the diversification of the economic activities in the rural area and to build and develop new agricultural and rural strategies.

## RESULTS AND DISCUSSIONS

The effective absorption rate of the European Structural and Investment Funds (ESIF) is one of the indicators that are quantified to establish statistical data regarding the status of programs funded through these instruments.

Alongside the effective absorption rate, data on indicators such as total sums allocated to programs, actual payments to beneficiaries, pre-financing requested, and the current absorption rate (requested sums) are typically analysed. The absorption rate is calculated as the ratio between the actual funds used and the initially allocated funds. A high absorption rate indicates that the structural funds have been managed and utilized efficiently.

According to data recorded between 2019 and 2022, in the statistics of the MIPE (2023), the effective absorption rate of the entire ESIF has continuously increased from:

- 9.12% in 2019 to 42.11% in 2020, 49.05% - - in 2021, and up to 63.02% in 2022. (Figure 1).

The share recorded in 2022 was more than double compared to that of 2019, and it is expected that in 2023 there will also be an increased effective absorption rate for the entire ESI Fund as well as individually for each dedicated program.

The curves of effective absorption rates at the PNDR and the overall FESI level can be observed in Figure 1. Within the PNDR, there is an increase in the percentage between 2019 and 2020, and between 2021 and 2022. However, there is also a decrease of 5.98 percentage points in 2021 (59.93%) compared to 2020 (65.91%). In correlation with the information in Table 1, it can be observed that the actual amount used is higher in 2021, but the absorption rate is lower compared to the previous year due to the fact that the actual allocated amounts were higher. The curve corresponding to the overall FESI shows no decreases in the analysed period, and the actual allocated amounts to the entire program have increased each year, reaching a total of over 35 billion euros in 2022.

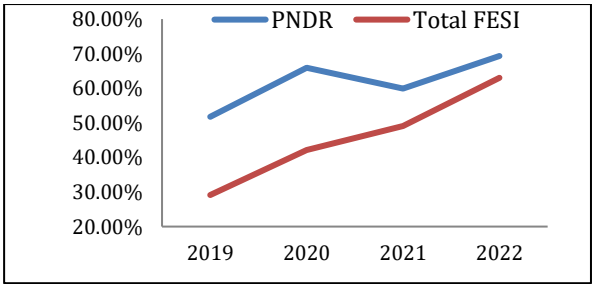


Fig. 1. Effective absorption rate of PNDR –FESI (%)
Source: Authors, by using MIPE (2023) [8].

Table 1 shows the amount of the effective absorption rate within the PNDR program can be observed (in euro and %).

Table 1. Effective absorption rate for PNDR 2019-2022

| Year | Value | Amount |
|---|---|---|
| **2019** | Euro | 4,206,411,278 |
| | % | 51.75 % |
| **2020** | Euro | 5,357,532,471 |
| | % | 65.91% |
| **2021** | Euro | 6,572,708,788 |
| | % | 59.93% |
| **2022** | Euro | 7,603,862,184 |
| | % | 69.33 % |

Source: Authors, by using MIPE (2023) [8].

As evidenced by the increased values recorded, it is certain that PNDR beneficiaries understood the real opportunity offered by the program and consequently accessed this funding source, propelling the effective absorption rate to the first place, compared to all other programs of the European Structural and Investment Fund (ESIF). In comparison to the effective absorption rate at the level of the entire ESIF, it can be observed that PNDR, compared to ESIF, records higher percentages as follows:

-In 2019, 51.47% compared to 29.12%
-In 2020, 65.91% compared to 42.11%
-In 2021, 59.93% compared to 49.05%
-In 2022, 69.33% compared to 63.02%.

These records show that over the course of the 4 years, the effective absorption rate began to increase for other programs as well, with only a 6.31 percentage point difference between PNDR and ESIF in 2022, while in 2019 there was a major difference of 25.35%.

Since it is certain that sustainable and stable development is possible through an increase in investment levels in the agricultural sector, data on the total net values of investments registered in Romania in the agricultural field were taken and analysed.

In Table 2, the total net values of investments in the agricultural sector in the period 2019-2021 can be observed, along with the calculation in percentages of the sums effectively absorbed from the PNDR program, as if the sums from the program were the sole source of funding.

Table 2. Net investments in the Romanian agriculture 2019-2021

| Year | RON (mill. of) | Annual average (Euro) | Euro (mill. of) | PNDR absorption rate (%) |
|---|---|---|---|---|
| **2019** | 5,552 | 4,7452 | 1,170 | 27.82 |
| **2020** | 5,344 | 4,8371 | 1,104.8 | 20.62 |
| **2021** | 5,695,5 | 4,9204 | 1,157.5 | 17.61 |

Source: Author's calculations based on INSSE/BNR data (2023) [10].

It should be noted that for the total net investments in the agricultural sector, there were other sources of financing during the period analysed, such as the Operational Program for Fisheries and Maritime Affairs (POPAM) and the European Agricultural

Guarantee Fund (FEGA), national funds, or the own sources of enterprises in this sector.

The information regarding the amounts recorded by INSSE was converted into euros from the national currency at the average National Bank of Romania (BNR) exchange rate to correlate with the amounts effectively absorbed by the PNDR program. If the entire level of net investments made in the agricultural sector in Romania during the period 2019-2021 were only made from the PNDR source, it can be concluded that percentages of less than 30% in the use of funds for investments are recorded, and the curve becomes descending until a percentage of 17.61% in 2021.

The amounts allocated for investments are becoming smaller, indicating that enterprises in the agricultural sector allocate more and more financial resources for current and variable expenses such as raw materials, materials, transportation, rents, utilities, human resources, or taxes and fees. The role of the amounts allocated to investments is very important because the most reliable path to economic growth is based on expanding investments, modernizing technologies, and constantly aligning with new quality standards. It is desirable for the proportion of amounts for the total net investments in the agricultural sector to be as high as possible regardless of the source of funding, and the implementation guidelines of the PNDR program support the allocation of the highest possible percentage for investments.

Figure 2 and Figure 3 show the share of PNDR funds in 2019 and 2022, from the total amounts absorbed by FESI.

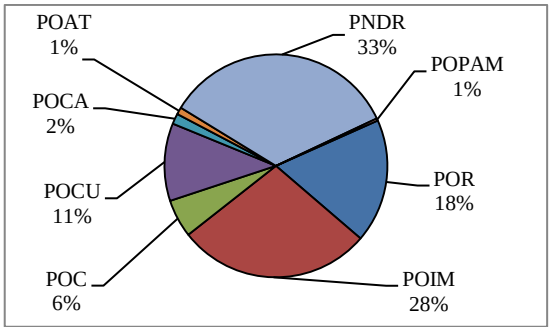


Fig. 2. Absorption rate (% of FESI, 2022)
Source: Authors, by using MIPE (2023) [8, 9].

In 2019, the program allocated a very high percentage of 47%, and over the years until 2022, the rest of the programs follow the absorption model of the PNDR, so that the proportion reaches 33%.

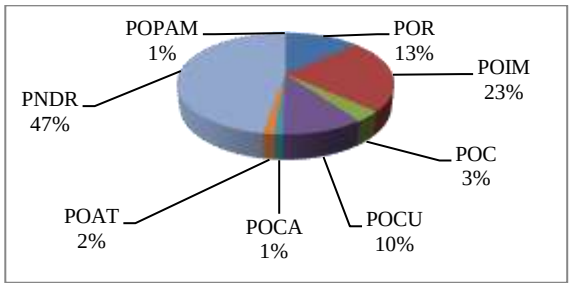


Fig. 3. Absorption rate (% of FESI, 2019)
Source: Authors, by using MIPE (2023) [8].

Even following such behaviour, the beneficiaries of the PNDR program maintain the first place in terms of the volume of amounts effectively absorbed.

In second place in terms of absorption proportion from the total FESI, both in 2019 and 2022, is the Large Infrastructure Operational Program (POIM), with a growth of 5 percentage points from 23% in 2019 to 28% in 2022.According to the MIPE (2022), the overall objective of the POIM is the development of transport, energy, environment, and risk prevention infrastructure to European standards. The POIM program indirectly supports the agricultural sector by offering compatible and high-standard infrastructure for most of the activities in the entire agricultural sector in Romania. In third place in the ranking of amounts absorbed from the total FESI is the Regional Operational Program (POR), and in fourth place is the Human Capital Operational Program (POCU), which has specific objectives in the field of human resources. Through POCU, actions related to the agricultural sector are also undertaken, as there are numerous projects in implementation through which the human resource, from technicians and specialists in agriculture to tractor drivers, agricultural mechanics and plant and animal growers, is qualified. The rest of the programs recorded absorption rates of under 10% of the total structural funds throughout the years 2019-2022.

The Operational Program for Fisheries and Maritime Affairs (POPAM) records the lowest effective absorption rates, but it is also the program that has considerably lower allocated funds compared to the rest, and in a general calculation, it can be attributed to programs targeting the agricultural sector and quantified alongside PNDR. Table 3 shows the amounts of the effective absorption rate recorded by each program and transformed into percentages of the total ESF. Such a comparative calculation with the effective rate of programs from the total allocated shows us the evolution in percentages reported to the final amount effectively absorbed. ESF, of a total percentage of 100%, is mainly redistributed towards PNDR, this program being a true example to follow for beneficiaries of other programs.

Table 3. Effective absorption rate on FESI (2022)

| Operational Programme | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|
| **POR** | 13% | 17% | 18% | 18% |
| **POIM** | 23% | 23% | 25% | 28% |
| **POC** | 3% | 3% | 5% | 6% |
| **POCU** | 10% | 13% | 19% | 11% |
| **POCA** | 1% | 1% | 1% | 2% |
| **POAT** | 1% | 1% | 1% | 1% |
| **PNDR** | 46% | 40% | 38% | 33% |
| **POPAM** | 1% | 1% | 1% | 1% |

Source: Authors, by using MIPE (2023) [8].

It is also noticeable that one of the lowest percentages is attributed to the Competitiveness Operational Program (POC), which in 2021 managed to absorb only 6% of the total ESF. Finally, with a constant percentage of 1% over the analysed period, the Administrative Capacity Operational Program (POCA) and the Technical Assistance Operational Program (POAT) are ranked.

## CONCLUSIONS

The study conducted shows the importance of absorption indicators for structural and investment funds, and from it, a series of practical and theoretical conclusions can be drawn that can be applied in any field, but especially the information obtained can be used in the agricultural sector.

At the national level, according to data from the analysed period, the rate of effective absorption of structural funds has steadily increased, indicating a more efficient use of these funds, and only in 2022 has the percentage become notable and impactful in Romania.

PNDR program has been able to use structural funds more efficiently during the analysed period, and the increase in the rate of effective absorption shows that the program's beneficiaries have understood the opportunities it offers. A careful analysis of performance indicators can help identify problems and improve the management of structural funds in other programs funded through the FESI.

While all these figures show a significant improvement in the rate of effective absorption, some of the challenges and problems associated with funding programs from the FESI, and even from the PNDR, must also be taken into account. For example, in some cases, the procedures for applying, obtaining, and implementing funding can be complex and cumbersome, which can discourage some organizations from applying. Additionally, it may be difficult for some organizations to identify suitable projects for funding or to successfully implement funded projects if there is not a high level of information and communication within each organizational structure. Although PNDR has brought significant benefits in terms of rural development, there are still many challenges to be overcome to ensure sustainable development of these areas. These include reducing the gap between urban and rural areas, improving road and public transport infrastructure, increasing the level of education and professional training of rural populations, as well as promoting a culture of entrepreneurship and innovation in rural areas. In this regard, it is important for PNDR to be continuously updated and adapted to the current needs and priorities of rural areas in Romania, so that it can continue to support their development and contribute to reducing socio-economic disparities.

As a final conclusion, the increase in effective absorption rates of European Structural and

Investment Funds represents an important achievement for Romania and shows that beneficiaries and authorities have understood and appreciated the opportunities offered. However, collective efforts must continue to ensure sustained progress.

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# STUDY ON THE EVOLUTION OF FAIR TRADE AND ITS ROLE IN SUSTAINABLE DEVELOPMENT

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***Abstract***

*One of the great current challenges at the global level is represented by finding sustainable production systems that ensure both social, economic and environmental sustainability, while at the same time pursuing the optimal provision of production, trade or consumption indicators. Globalization is the one that affected those producers who, not having access to alternative markets, had to sell their goods at much lower prices, thus making the very principles of equity and efficiency affected. The solution was represented by the practice of fair trade and the application of sustainable supply systems, which represent ways to solve these shortcomings. This paperanalyzes the situation of fair trade worldwide and its evolution for the period 2012-2020. The research methodology assumed the collection of data, their processing and analysis with the help of some statistical indicators such as: the number of Fairtrade organizations, the number of Fairtrade farmers, the number of workers in Fairtrade organizations, the proportion of women involved in Fairtrade activities, the areas intended for obtaining Fairtrade productions, Fairtrade productions, premiums granted in Fairtrade. The data highlighted the fact that worldwide, during the analyzed period, there was a continuous increase in fair trade, the increase being over 65% in terms of the number of producer organizations. The number of farmers reached over 1.77 million in 2020, this being the result of understanding the role of affiliation to this form of trade. The largest number of producers participating in fair trade are producers of coffee, tea or cocoa, their share being, in the analyzed period, between 86-92%. The paper highlights the fact that the emergence and development of fair trade represented a way of supporting farmers and agricultural workers in developing countries,this can be done both by the political environment, but also by society. Although the application of these measures has contributed to the increase in the standard of living, to the respect of the rights of farmers and workers, equally with the principles of sustainable development, the weight of fair trade in all trade, proves the fact that it is still carried out on a small scale, as there is a need for the development yes, with the aim of reducing global poverty..*

***Key words:*** *fair trade, sustainability, profitability, globalization*

## INTRODUCTION

The concept of fair trade, although it started to be used at the end of the 50s, has its origin in a novel belonging to Max Havelaar, which is the pseudonym under which Eduard Douwes Dekker publishes, and which had as its subject the fight over a government system from Java, a Dutch colony, which exploited the work of the natives [1]. More than a hundred years ago, a priest from Mexico, who belonged to the Dutch church, was the one who laid the foundations for labeling the coffee obtained by small farmers, with the aim of being differentiated from the rest of the coffee varieties, thus supporting their work. In Great Britain, in 1881, through various economic-financial mechanisms, an attempt was made to limit the import of products that were unfairly competing with domestic products, thus creating a fair trade movement.
As an official form of organization and recognition, fair trade appeared at the end of the 1940s in America, where an organization called "Ten Thousand Villages" hired labor from Puerto Rico, with the aim of protecting the disadvantaged population [2]. It was also then that the movement to encourage trade in

goods produced by poor communities began, and the first fair trade store thus appeared in 1958.

In Europe, there were different initiatives: in the 50s, in Great Britain, the Oxfam store started selling handicrafts that were created by Chinese refugees, and in 1964 the first organization dealing with fair trade was founded [17].

In 1988, in the Netherlands, the "fair trade Max Havelaar" label was created for products that are sold only in the Netherlands, France, Belgium and Switzerland.

In 1997, an international labeling association called Fairtrade Labeling International was founded, which still deals with establishing international standards for fair trade. The association certifies production processes and audits commercial agreements [22]. Also, the International Fair Trade Organization monitors this form of trade in order to strengthen its credibility, but also to ensure quality management, developing a new label, a WFTO Logo, which is used by those organizations that have a commitment of 100% compared to fair trade in their business activities.

The purpose of creating the fair trade movement was to reduce poverty in countries from Africa, Latin America and Asia for farmers disadvantaged by globalization, for whom it thus created access to developed markets and the opportunity to receive fair prices, such as those existing on the world market, which would allow them to cover production costs, obtain profit and ensure decent working and living conditions [8, 9, 11, 15]. By means of "fair trade" both food products (which are produced only in poor areas of the world) and non-food products (from cotton to clothes and gold) are sold and represent the source of real industries in developed countries.

Therefore, the "fair trade" movement appeared as an alternative to transnational corporations that exploited certain countries or certain producers or excluded them from commercial organizations [10, 12]. In this way, the movement allowed farmers to associate, to improve their way of acting and ethical behavior, to respect the rights of the community, but at the same time to ensure a partnership with consumers, who thus have the opportunity to pay the right price and to participate in ensuring a decent life for producers and workers, under the conditions that they, together, receive approximately 20% of the profit obtained, the rest going to the intermediary (transporters, importers, traders) [13, 18, 21].

Fair trade is thus a solution to eliminate barriers and deficiencies related to the way goods and services are sold, human rights, ethical conduct, fair wages, etc. aspects that are established through the principles of fair trade, number 10 [20].

These principles refer to: offering opportunities for these disadvantaged producers both from the point of view of production, as well as marketing and association; to ensure transparency, but also responsibility; to ensure fair trade systems; to ensure fair wages; to combat the involvement of children in forced labor; to non-discrimination, to gender equality; to ensure decent working conditions; to the promotion of fair trade; to ensure the sustainability of the environment [2].

The European Union, the World Trade Organization, various non-profit organizations support the "fair trade" policy, encouraging their integration into the world economy. Over time, there have been various actions aimed at raising awareness of public opinion regarding the purchase of products bearing the "fair trade" label, as a form of supporting farmers and eliminating intermediaries. At the same time, the development of rural areas, interconnected with the agricultural and commercial sector, was desired. The trade movement concerned and continues to concern both political and social actors, but also researchers, who want to find the best solutions to support and promote fair trade [16].

## MATERIALS AND METHODS

In the present work, we analyzed the evolution of fair trade in the period 2015-2020. For the characterization of fair trade, the indicators collected, analyzed and

interpreted were: the number of Fairtrade organizations, in total and by region; the number of Fairetrade farmers, in total and by region; the number of workers in Fairtrade organizations, in total and by region; the share of women involved in Fairtrade activities; surfaces intended for obtaining Fairtrade productions; Fairetrade products obtained; premiums granted in Fairtrade, in total and product categories. In the realization of this work, statistical data were used regarding fair trade carried out worldwide, which were processed, analyzed and interpreted, thus resulting in conclusions regarding the fair trade situation from 2015-2020.

The statistical information was analyzed dynamically, using indicators with a fixed base and with a chain base:

$$I^{y}_{t/t'} = \frac{yt}{yt'} \; x \; 100 \quad \text{.....(1) [19]}$$

$$I^{y}_{t/t'} = \frac{yt}{yt-1} \; x \; 100 \text{.....(2)}$$

where:

y - the level of the analyzed phenomenon

t, t', t-1 - the moments of time.

## RESULTS AND DISCUSSIONS

The data published in the period 2014-2022 highlight the fact that the number of producer organizations belonging to fair trade increased continuously in the period 2012-2020.

The annual growth rates vary from 1.14% in 2015 compared to 2014, to 13.79% in 2016 compared to 2015.

However, in the analyzed period, the increase from 2020 compared to 2012 was 65.05%, which highlights the increased interest of producers in entering the fair trade system, due to the increase in consumer interest in the origin of the products and their production method [14], the involvement of non-profit organizations in supporting the "fair trade" movement, but also the policies to support this form of trade.

The dynamics of fair trade producer organizations is shown in Figure 1.

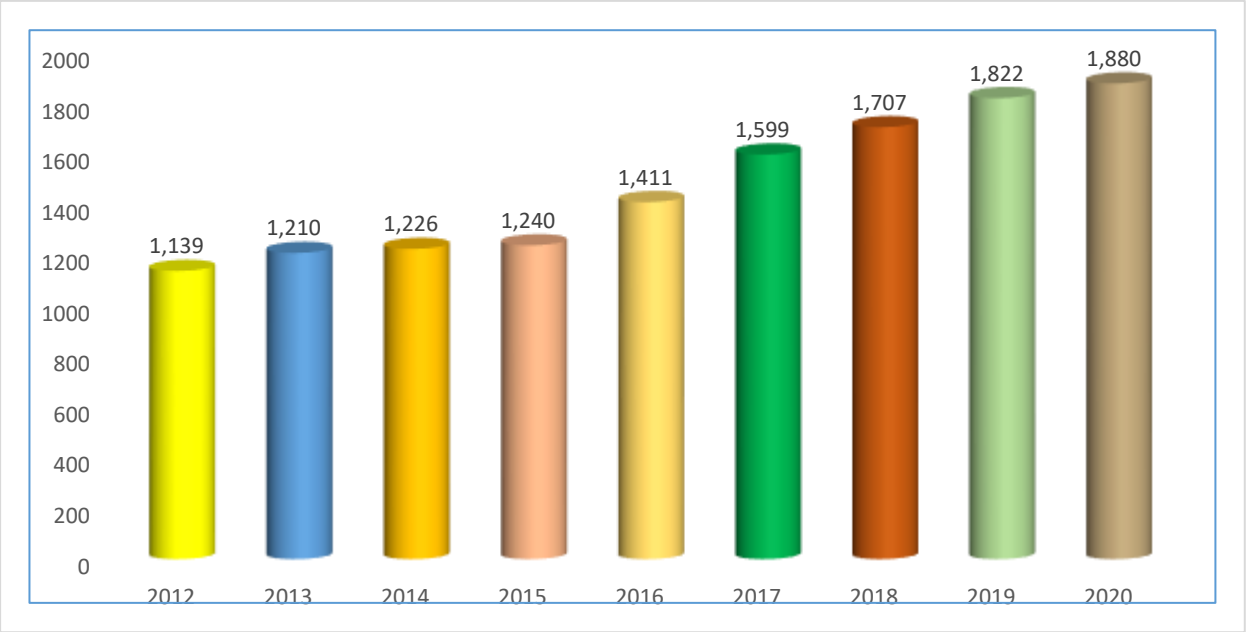


Fig. 1. The evolution of fair trade producer organizations
Source: own processing based on the data from [3, 4, 5, 6, 7].

Between 2012 and 2020, the number of organizations involved in fair trade in the Latin American and Caribbean region represented almost half of their total, in terms of the evolution of the number of organizations on the first 2nd place is Asia and the Pacific, with an increase of almost 90%. The other 2 regions recorded increases of approximately 60%.

The number of countries where these organizations are located reached 75 in 2020, fluctuating from 71 to 75 in the analyzed period.

As for geographical distribution, the largest share of them is in Africa and the Middle East, followed by those in Asia and the Pacific and then by those in Latin America and the Caribbean.

Figure 2 presents the dynamics of faor trade producer organizations by region.

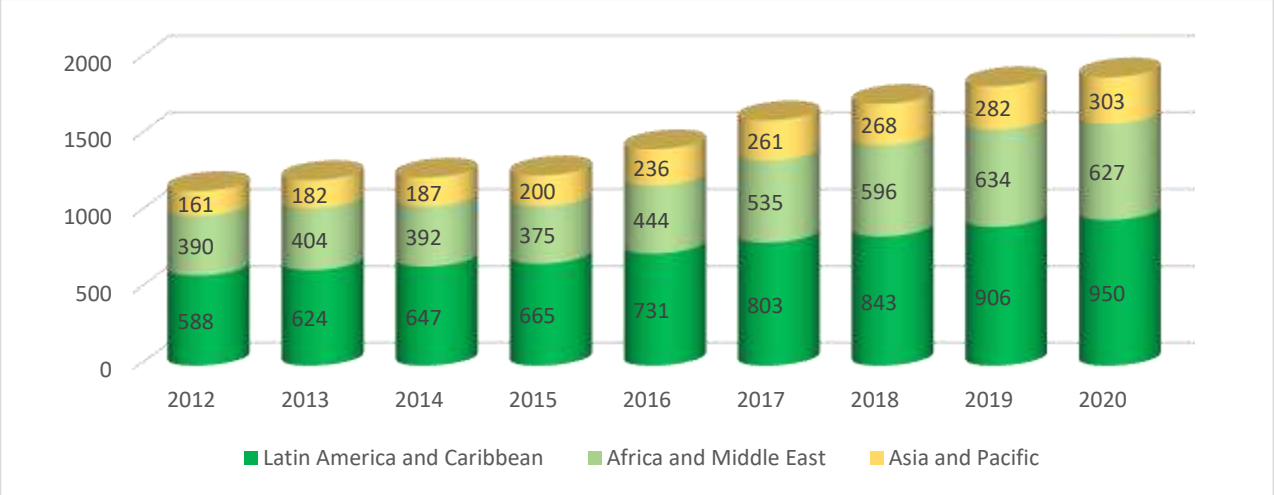


Fig. 2. The evolution of fair trade producer organizations, depending on the region
Source: own processing based on the data from [3, 4, 5, 6, 7].

In the period 2012-2020, the number of farmers in the analyzed areas increased constantly from 1.22 million in 2012, to 1.77 million in 2020, while in 2013 approximately 211,000 workers were involved in these activities,the increase compared to the previous year being approximately 26%. Starting with 2017, the number of workers started to decrease (from 193,000 workers in 2017 to almost 179,000 workers in 2020).

An analysis of producers by region highlights the fact that almost two-thirds of them come from Africa and the Middle East.

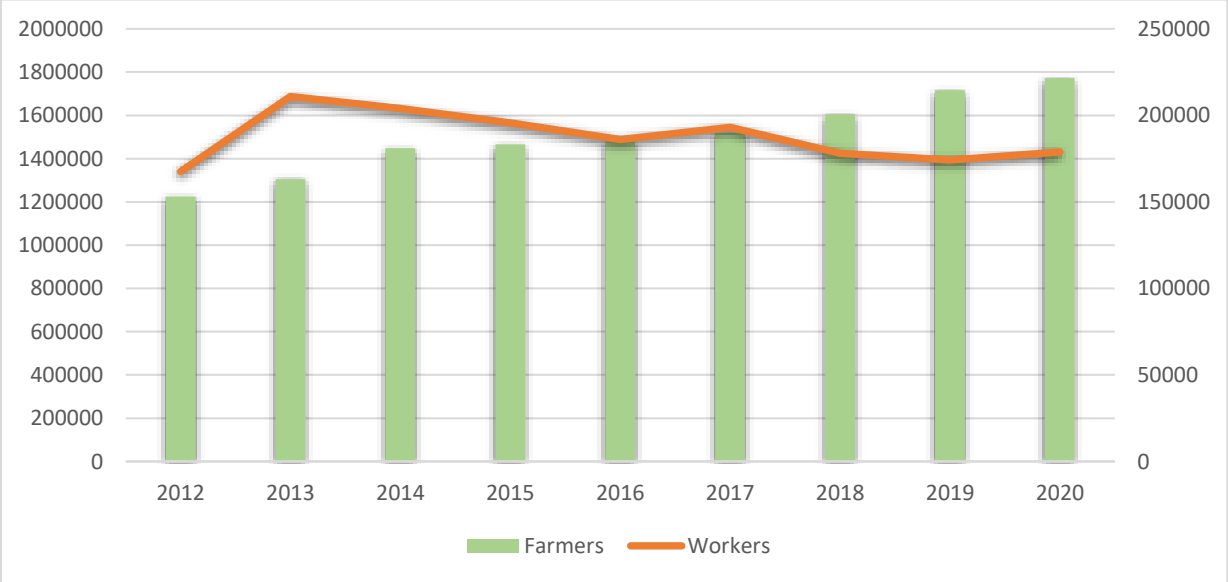


Fig. 3. The evolution of the number of farmers and workers involved in fair trade
Source: own processing based on the data from [3, 4, 5, 6, 7].

Another peculiarity is the fact that the highest growth rate of the number of producers was recorded in this region.

Increases were also recorded at the level of other regions. It was found that the need for labor and workers differs from one region to another, being correlated with the level of development of fair trade and the specialization of farms.

The most important increase was recorded in Latin America and the Caribbean, where the number of workers almost doubled.

In the Asia and Pacific region, the number of workers decreased by a third.

The dynamics of the numbre of farmers and workers involved in fair trade is shown in Figure 3.

It is found that there is an inversely proportional relationship between the large number of accredited farms and the number of fairtrade workers who, although they are increasing, continue to produce without being properly remunerated due to the fact that they come from low and medium income countries, where both the remuneration of the workforce and and the profit obtained by the farmer continues to represent a small share of the final price of the traded goods.

Table 1. The evolution of the number of farmers, depending on the specialization of production

| Culture | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| Coffee | 795,457 | 762,392 | 758,474 | 795,023 | 838,116 |
| Tea | 259,000 | 305,469 | 328,273 | 319,558 | 335,274 |
| Cocoa | 223,579 | 263,825 | 322,363 | 415,971 | 440,226 |
| Bananas | 10,707 | 10,385 | 11,463 | 11,465 | 10,376 |
| Cane Sugar | 54,063 | 54,960 | 55,227 | 37,075 | 36,731 |
| Seed Cotton | 46,305 | 45,153 | 45,576 | 43,282 | 44,480 |
| Other Products | 86,957 | 77,926 | 83,634 | 93,871 | 67,165 |

Source: own processing based on the data from [3, 4, 5, 6, 7].

Worldwide, there are farms specialized in the production of three categories of products that sum up the largest share of workers, these being coffee, tea and cocoa (approximately 90%).

It is obvious that there is a direct relationship between the number of producers involved in fair trade and the market demand for these product categories.

Table 2. The evolution of the number of workers, depending on the specialization of production

| Culture | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| Flowers and Plants | 54,160 | 57,863 | 69,369 | 67,199 | 73,220 |
| Tea | 93,157 | 87,230 | 61,975 | 59,195 | 55,148 |
| Bananas | 11,337 | 14,639 | 16,705 | 23,508 | 26,106 |
| Other Products | 27,332 | 33,275 | 30,002 | 24,234 | 24,321 |
| Coffee | 0 | 0 | 0 | 0 | 0 |
| Cocoa | 0 | 0 | 0 | 0 | 0 |
| Cane Sugar | 0 | 0 | 0 | 0 | 0 |
| Seed Cotton | 0 | 0 | 0 | 0 | 0 |

Source: own processing based on the data from [3, 4, 5, 6,7].

There is also a direct correlation between the category of consumers and the price they are willing to pay for these products.This makes the representation of farmers stronger among the organizations, and the support given to them is significant in relation to that given to other categories of crops and products.

It is thus established that in relation to the country of origin, in relation to the categories of crops belonging to the respective countries, those changes take place in terms of both the number of workers and farmers involved in forms of fair trade.

Regarding the number of workers on Fairtrade farms, it is noted that there are categories such as farms producing coffee, cocoa, cane sugar, seed cotton, where the activities are performed only by farmers, without workers.

The majority of workers carry out activities in farms producing tea (50% in 2016 and 31% in 2020), flowers and plants (30% in 2016 and 41% in 2020) and banana (6% in 2016 and 15% in 2020).

One of the objectives of Fairtrade is to grant a fair salary for women who work in these fields.

Statistics show that the share of women who are members of producer organizations has doubled in Africa and the Middle East.

In Latin America and the Caribbean, during the analyzed period, there were decreases of 27%, and in Asia and the Pacific of 40%.

The number of women working in fair trade farms is inversely proportional to the number of women involved in trade organizations. As their degree of involvement in organizations increases, their rights begin to be recognized. In the period 2012-2020, the situation of the number of women who worked in farms practicing fair trade was as follows: an increase in their number for the Latin American and Caribbean regions and a reduction close to half for the women employed in the Latin American and Caribbean region (Figure 4).

On the other hand, the principles of fair trade aim precisely to respect gender equality (ability to hire and pay, methods of dismissal, retirement, but also aspects related to age, race, ethnicity, caste, sexual orientation, but also right of association , organization or membership).

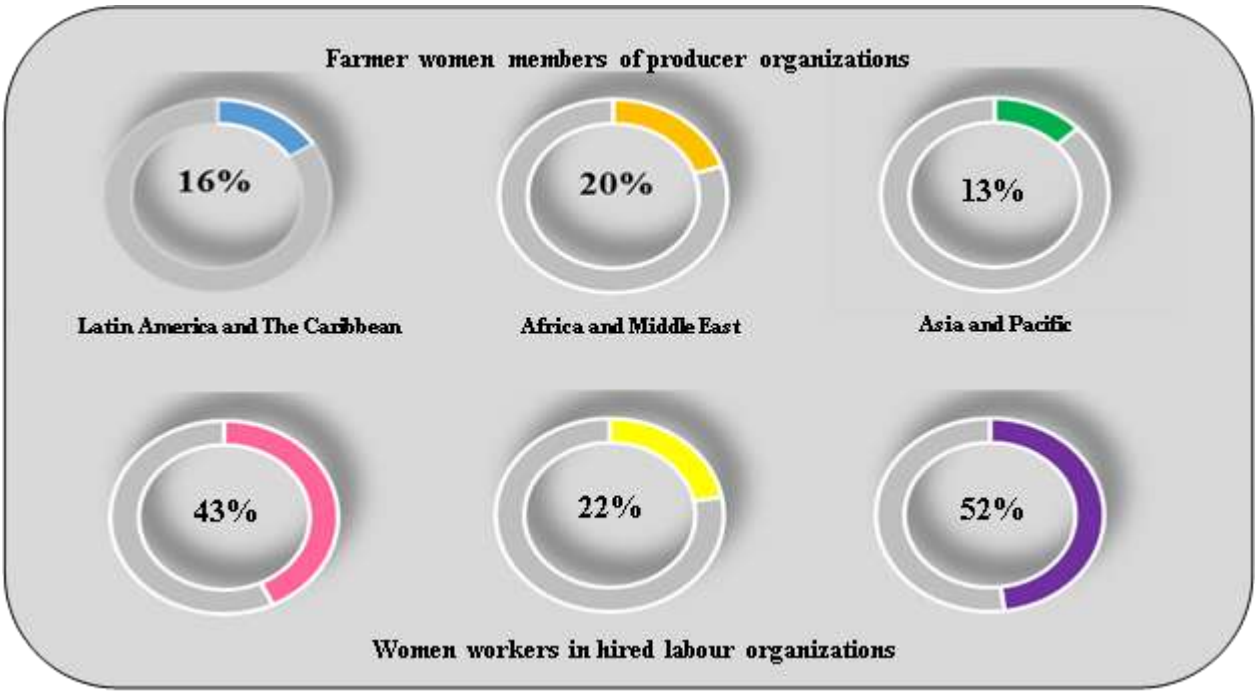


Fig. 4. Share of women involved in Fairtrade in 2020 (%)
Source: own processing based on the data from [3, 4, 5, 6, 7].

Table3.The evolution of surfaces in the period 2015-2020 (hectares)

| Culture | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| Coffee | 1,046,813 | 938,158 | 961,774 | 1,372,820 | 1,127,766 |
| Cocoa | 722,060 | 1,170,612 | 1,178,644 | 1,001,002 | 1,416,653 |
| Cane Sugar | 152,991 | 146,388 | 149,738 | 124,030 | 104,868 |
| Tea | 126,259 | 135,155 | 136,453 | 113,382 | 124,954 |
| Fresh fruit | 62,609 | 33,614 | 30,997 | 30,812 | 30,931 |
| Seed Cotton | 49,985 | 62,899 | 55,516 | 48,763 | 62,041 |
| Bananas | 36,487 | 38,316 | 41,143 | 46,887 | 48,583 |
| Rice | 28,518 | 33,133 | 24,102 | 21,947 | 20,982 |
| Wine grapes | 12,435 | 12,954 | 12,302 | 14,054 | 12,865 |
| Flowers and Plants | 2,540 | 2,698 | 2,824 | 2,808 | 3,355 |
| Dried fruit | 2,354 | 3,244 | 2,689 | 630 | 224 |

Source: own processing based on the data from [3, 4, 5, 6, 7].

Regarding the areas occupied by the cultures integrated in the Fairetrade system, the statistical data highlight the fact that the coffee, cocoa, cane sugat and tea cultures are

on the first 4 places. The areas occupied by coffee crops were always in the first place, but the years 2019 and 2020 had the maximum of the analyzed period. This was due to the method of certification of the producers, but also to the changes in the structure in terms of production. The mentioned measures also influenced the cocoa crop, which occupied the largest area in 2020, growing from one year to the next, during the analyzed period. The crops where the cultivated areas decreased, in the period 2012-2020, were cane sugar, rice, dried fruit. The areas occupied by tea and wine grapes were relatively constant, while the crops for which the cultivated areas increased were bananas and flowers and plants (Table 3).

The productions obtained from the main Fairtrade crops were in turn influenced by the cultivated areas, thus showing an increase in the total production for coffee (by 48% in 2020 compared to 2015), cocoa (116%), banana (49%), flowers and plants (31%), fresh fruit (254%), wine grapes (29%), nuts (124%) and honey (33%). The crops for which the production in the period 2014-2020 decreased, as a result of the correlation with the occupied surfaces, were tea (25%), sugar cane (47%), seed cotton (39%, after a decrease of 57% in 2017), rice (20%). The most important decreases were recorded for dried fruit (92%) and fruit juice (78%). What influences the volume of production, in addition to climatic and pedological conditions, are the policies to support these cultures (Table 4).

The revenues obtained by the producers who are part of the fair trade system are supplemented by applying a fair trade premium, the condition being compliance with the rules for the development of this form of trade, according to which the cultivated areas are sized. In 2020, the first generated by the productions obtained in the Fairtrade system reached up to 150 million Euros, being distributed as follows: 54% coffee, 19% bananas and cocoa, 4% sugar cane and flowers and plants, 2% tea and 1% seed cotton , their weights being close to those of the premiums granted in 2015 (47% for coffee, 18% for banana, 16% for cocoa, 6% for flowers and plants, 4% for tea and 1% for cotton). The use of these funds is decided by farmers and workers, they are intended both for the development of their own farms by making investments, obtaining certifications, but also to support the community through infrastructure or various social services.

Table 4. Evolution of Fairtrade production (thousands of tons)

| Culture | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| Coffee | 153.31 | 179.72 | 185.78 | 214.43 | 260.97 | 233.50 | 226.34 |
| Tea | 11.05 | 11.53 | 12.12 | 10.73 | 9.84 | 8.04 | 8.34 |
| Cocoa | 81.19 | 102.18 | 136.54 | 214.43 | 207.65 | 218.16 | 175.41 |
| Bananas | 495.12 | 552.84 | 579.08 | 641.92 | 686.93 | 747.43 | 738.87 |
| Cane Sugar | 227.56 | 155.33 | 166.56 | 207.44 | 199.21 | 175.86 | 120.23 |
| Seed Cotton | 19.35 | 18.41 | 10.38 | 8.31 | 10.19 | 10.27 | 11.76 |
| Flowers and Plants | 720,657.58 | 786,704.90 | 829,101.64 | 834,750.34 | 825,359.87 | 933,782.93 | 943,858.88 |
| Dried fruit | 2.21 | 1.88 | 0.83 | 1.19 | 0.51 | 0.33 | 0.17 |
| Fresh fruit | 32.06 | 33.95 | 53.53 | 50.99 | 53.58 | 117.74 | 113.55 |
| Fruit juice | 6.83 | 7.01 | 21.31 | 20.37 | 19.732 | 3.38 | 1.53 |
| Wine grapes | 35.04 | 29.41 | 37.16 | 46.70 | 49.60 | 56.89 | 45.27 |
| Rice | 12.02 | 9.94 | 10.38 | 11.04 | 11.94 | 9.66 | 9.56 |
| Nuts | 6.28 | 3.17 | 3.84 | 9.87 | 12.46 | 13.14 | 14.08 |
| Honey | 3.03 | 3.25 | 3.26 | 3.13 | 3.57 | 4.58 | 4.02 |

Source: own processing based on the data from [3, 4, 5, 6, 7].

From the point of view of the amounts granted as premiums in 2020 compared to 2015, from the analysis of the statistical data it appears that the biggest increases were recorded for nuts (+331), fresh fruits (+158%), seed cotton (+ 101%), cocoa (+51%), bananas (26%), wine grapes (+35%), coffee (+16%) or flowers and plants (+6%). These increases are correlated both with the cultivated areas, but also with the productions obtained.

The crops where there were decreases in premiums are those where there were also decreases in production: fuit juice (-88%); dried fruit (-83%); cane jugar (-30%); rice (-69%); tea (-67%).

However, it should be emphasized that although in 2020, more than 5.8 billion fair trade products were sold worldwide, Fairtrade trade held a market share of only 1.8% of the global market.

This proves that this area of fair trade can still be improved. As the principles of fair trade have been improved and supplemented over time, support decisions consisting in the application of economic or social measures can be reconsidered. Likewise, the promotion of fair trade among consumers can be expanded. Numerous non-profit organizations do this, but the examples of good practices can be multiplied and applied not only to products originating from the countries of the three established regions, but also to other products from countries that face a reduced support for traditional products that often represent a source of considerable income for producers.

## CONCLUSIONS

Fair trade appeared as a way of supporting farmers, farmers and workers in developing countries, who without real access to a fair market could not and still cannot secure the resources necessary for a decent living.

In this way, the necessary conditions for obtaining fair prices, income and economic self-sufficiency were created, they were allowed to participate in the decision-making processes, a fair remuneration was ensured, and an equal remuneration for women and men for the same work performed, ensuring the well-being, security, right to education and play of children, ensuring adequate working conditions for all persons involved in production activities, the cultural identity of the respective areas was promoted, but also the use of sustainable production technologies.

In 2020, the number of farmers involved in fair trade approached 1.8 million, which proves its importance.

At the same time, the number of farmers who joined and signed up in different forms of organization increased, this being also encouraged by the granting of premiums for the crops obtained, the level of the premiums which influenced the analyzed period and the structure of the crops.

As a result of the fact that participating in fair trade involves the payment of taxes which for many of the farmers are not small, they cannot certify, which makes fair trade seem prohibitive, violating the very principles that make this trade "fair".

Critics of fair trade draw attention to the fact that sometimes, the wages obtained by workers from fair trade can be lower than those from workers from classic trade, due to the attempt to increase profit or cover additional costs, which again contravenes the principles of trade fair. They claim that this form of trade largely supports only the producers, and less so the workers, being sometimes just a marketing action, to increase the visibility of certain categories of producers, who do not always respect the ethical principles.

On the other hand, the products with the fair trade logo are addressed to that category of buyers who can purchase them.

The same critics consider, when it comes to consumers, that fair trade is nothing but a form of flattery to them, by the fact that it offers its help in supporting producers from poor countries.

The analyzed data showed that although the issue of fair trade is an important one, which was intended to ensure "equity", although it has registered more and more participants and applies to different categories of food and non-food goods, it still has a small market

share, which proves the necessity of its support, both at the political level, as well as at the economic and social level.

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# ANALYSIS OF RAW DATA RETURNED BY MOST USED ONLINE PUBLIC OPINION POLLS TOOLS

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***Abstract***

*The appearance and evolution of the questionnaire are strictly linked to the history of statistics as a science. Why is the questionnaire related to the history of statistics? As the questionnaire is not a simple list of questions, the important part behind the questions is the statistical interpretation of the answers received from respondents. We have entered several platforms of public opinion polling, with the idea of seeking maximum effect with minimum effort, from a beginner's position – how can an entrepreneur be at the beginning of the road. It was conduct research on how works and what deliverables give several platforms of public opinion polling. Each tool that loaded and launched the opinion poll on the consumption of craft beer gave answers with different characteristics, the only common basis being the choice of the free package. Results from Google Forms, ZoHo Survey, and Survey Monkey were analyzed and compared. Of all these, the easiest to work with and most complete is ZoHo Survey for those who don't want to use subscription services, and with some financial effort for a Survey Monkey subscription.*

***Key words*****:** *market research, survey, entrepreneur*

## INTRODUCTION

The history of statistics as a science is directly related to the appearance and development of the questionnaire. Why is the history of statistics relevant to the questionnaire? The statistical interpretation of the responses provided by respondents is crucial because the questionnaire is not just a list of questions. The first written questionnaire was used in 1838 to obtain complete information about the impartial history of strikes (Gault, R., 1907) [5].

One of the most important topics to be solved by statistics in the UK was related to the educational attainment of children from different backgrounds, especially the poor. All sorts of questionnaires have been dealt with on the issue of children's education for many decades. Concerns about statistical studies are also mentioned in other countries, among which it is well known that a statistical office founded in 1862 is taking place in Germany and then publishes a statistical yearbook (Statistical Bureau of Berlin, 1900-1902) [12].

If are maintain the questionnaire's objectives in mind from the first draft through the revisions made after pretesting, the processes of organizing and creating the questionnaire are much simpler [4], [8], [9]. When designing a questionnaire, it is common, to begin with a hypothesis or hypothesis of the study (Groves, R., Fawlers, F., Couper, M., Lepkovski, J., Singer, E., Tourangeau, R., 2009) [6]. If a literature review makes this suggestion, you may already have a framework that will guide the questions you should ask and the order in which they should be asked, or you may be using an already-existing tool, like a client satisfaction survey. Combining a completely structured questionnaire technique with an exploratory investigation in which interview subjects (perhaps key informants) are questioned in detail is also not uncommon (Boynton PM, Greenhalgh T., 2004) [1].

In an effort to have the greatest impact with the least amount of effort, we have entered many public opinion polling sites, in other words, to find through our own experience

which platform/instrument dedicated to our purpose is easier to approach, closer to general search results, and more advisable, from a not expert position.

Thus, research was conducted on the operations and outputs of various public opinion polling platforms with the goal of achieving maximum impact with the least amount of effort, or, in other words, to determine which platform/instrument dedicated to any entrepreneurship is simpler to approach, closer to general search results, and free of financial support.

The only factor that all of the tools that loaded and launched the opinion survey on craft beer consumption had in common was the selection of the free package. We studied and contrasted the responses from Google Forms, ZoHo Survey, and Survey Monkey.

The purpose of this paper is to make a comparative analysis of raw data returned by the most used online public opinion polls tools.

## MATERIALS AND METHODS

For the construction of the opinion poll on the consumption of craft beer we choose to conduct a quantitative analysis, because the primary focus of quantitative research is on numerical data and measurable, and at the end we done an analyze of the responses using statistical methods. The research question was defined before conducting the survey.

We use several types of questions such: question filter, factual questions, question control, question inquiries, scoring question (leader board or constant amount), etc.

The construction of an online survey tool is quite complicated, use deductive and inductive logic, and provides both basic functions granted in many cases free of charge to users and advanced functions of the market questionnaire offered for a fee(Dușa, A., 2014) [2], Efferit [3].

The chosen topic for which we have built and launched the opinion poll, is related to the functional craft beer product.

This paper does not aim to analyze the results of the online questionnaire by interpreting the answers received from the respondents to each question, so we will not use the formula:

$$\frac{\frac{z^2 x\, p(1-p)}{e^2}}{1+\left(\frac{z^2 x\, p(1-p)}{e^2 N}\right)} \quad \text{.....(1)}$$

Source: [7].

where:

N – population size

e – margin of Error (as a decimal)

z – Confidence level (as a z-score)

p – percentage value (as a decimal)

The number of responses required for a representative sample is calculated by reference to the margin of error.

For example, for a population size of more than 100,000 people, 1,100 responses are required for the margin of error of ±3%, for the margin of error of ±5% 400 responses are required, and for the margin of error of ±10% 100 responses are required.

The material used is provided by the internet network and consists of the different types of tools made available to users, both free of charge, with basic and surcharge facilities, in versions that can diversify the ways of interpreting the results and/or help collect responses from account users who are paid to periodically complete, according to their options, all sorts of market surveys.

To carry out the comparative analysis that we proposed, we used the method of analysis through information and data collection and the method of comparison. A special contribution was also made by the free discussions held over time with different people regarding the choice of the type of instrument to use to build and launch an opinion poll.

To run a logical route in the way of organizing the questions, we first introduced the social questions, after which we entered the topic itself, seeking to filter the responses received taking into account a certain percentage applied to the age area, home area, educational training area, etc. where appropriate to ensure a proportionate balance of responses and diversity of situations, which often results in the representativeness of the

statistical sample [10], [11]. The questionnaire included a total of 20 questions and is posted bellow.

*This survey is aimed at all people over the age of 18 on all social networks.*
*The theme of the survey is craft beer, which is known to have influence in the United States.*
*The objective of the questionnaire is to analyze the responses received from the various opinion polling platforms.*

*1. What age group do you belong to*
- *Between 18-25 years' old*
- *Between 26-35 years' old*
- *Between 36-45 years' old*
- *Between 46-55 years' old*
- *Over 55 years' old*

2. *Your genre is*
- *Male*
- *Female*

3. *Youlive in the*
- *Urban environment*
- *Countryside*

4. *What is the last degree achieved*
- *Baccalaureate*
- *Bachelor*
- *Master*
- *PhD*

5. *Study or perform core tasks in*
- *Public environment*
- *Private sector*

6. *The income level of the household per person belongs to this category*
- *Below 2,000 lei*
- *Between 2,001 – 3, 000 lei*
- *Between 3,001 – 4,500 lei*
- *Between 4,500 – 6,000 lei*
- *Over 6,001 lei*

7. *How many people do you have in your family?*
- *1*
- *2*
- *3*
- *More than 3*

8. *You're single or have a relationship*
- *Single*
- *Having a relationship*

9. *As you appreciate, the transition through the COVID-19 pandemic influenced your eating or drinking habits*
- *Yes*
- *No*
- *I don't have any opinion about that*

10. *Are you drinking beer*
- *Yes*
- *No*

11. *Do you like beer?*
- *Yes*
- *No*

*12. Do you drink craft beer*
- *Yes*
- *No*

*13. If the answer to the previous question is No, what is the reason why you are not drinking craft beer?*
- *Smell*
- *Taste*
- *Strongness*
- *Price*
- *Other*

14. *Sometime, in the future, would you be willing to drink craft beer*?)
- *Yes*
- *No*
- *Maybe*

15. *If yes,* u*sually, when you drink craft beer, you are*
- *Alone*
- *Together with friends or family*

16. *To order craft beer, often*
- *I go to the brewery, shop etc*
- *I order online*

17. *How many times do you drink craft beer monthly*
- *Once*
- *Twice*
- *Between2-5 times*
- *Over 5 times*

18. *How much do you spend monthly to consume the craft beer*?
- *Between 10-50 lei*
- *Over 50 lei*

19. *What is the main reason why you appreciate/prefer craft beer?*
- *Taste*
- *Smell*
- *Strongness*
- *Other*

20. *How much are you willing to pay for 1 L of craft beer?*
- *Under 20 lei*

- *Over 20 lei*

*Thank you very much for your answers*

For our survey we used online methods, the questionnaire was handed in by email and Facebook social network.

## RESULTS AND DISCUSSIONS

### Results obtained after launching the questionnaire in Google Forms

In short time after launching the questionnaire in Google Forms, the results begin to show up.


Fig. 1.A. How to display responses in the form of graphs collected in Google Forms (A)
Source: original data recorded from the research.

On Google Forms it was obtained some responses (34), with a wide range among respondents, the distribution of this survey was made through the social network Facebook. By default, Google forms open on the question area, but by switching to the next area – answers – it can be seen the options below (Figure 1).

What is visible on the surface is that each graph can be copied into a form that appears unique, i.e., pie chart. On the right, we find an elevator that certifies that the survey is still open and that further answers can be received (A). When we think we have enough answers, we can easily switch to the closed position.

The image bellow (B) highlights what appears by the action of the 3 points on the top right, where we are facilitated by several actions: We receive notifications for new answers, send answers by selecting the destination, and download the answers in .csv format, print all the answers or delete all the answers.

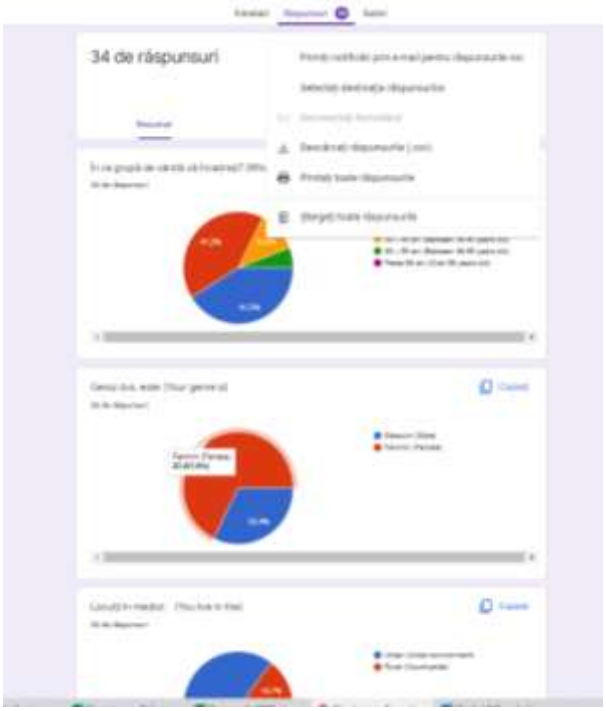


Fig. 1.B. How to display responses in the form of graphs collected in Google Forms (B)
Source: original data recorded from the research.

The CSV extension means "comma-separated values", each line representing a data record, and each record contains a field or fields that are separated by commas.

Unfortunately, it is not given the number of answers for each variant of the question, but only the percentage of respondents for each variant of the question.

The .csv format is not very helpful; the data is difficult to follow as can be seen in Figure 2.

Fig. 2. Display in .csv format from Google Forms
Source: original data recorded from the research.

The last area of the ***Answers chapter***, the one of the Individual, presents for each respondent the answers given for each question (Figure 3).

Those who want to make all sorts of correlations between the answers to the questions can gather and interpret how thoroughly they need the data. The only condition is to have the time, power, and patience to manually pass the received answers on an Excel file and make additional statistical interpretations, possibly using pivot tables.

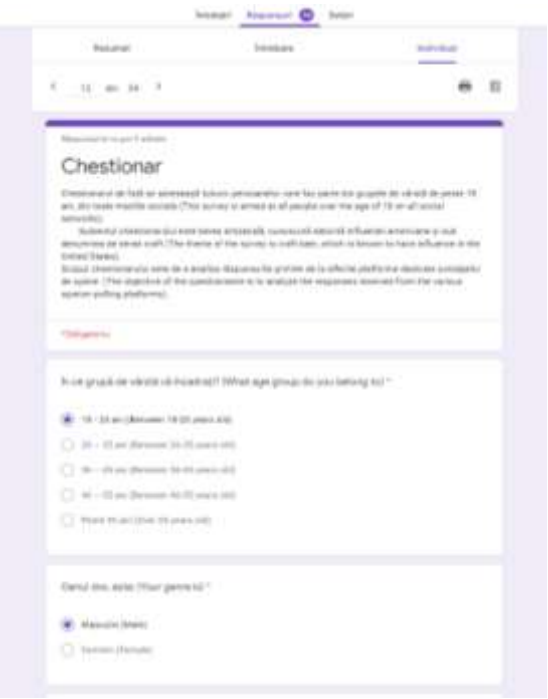


Fig. 3. Display questions one at a time
in Google Forms
Source: original data recorded from the research.

**Results obtained after the launch of the questionnaire in ZoHo Survey**

When opening the account in the ZoHo Survey, we choose which questionnaire we want, if we have multiple surveys or the only questionnaire hosted by this particularly useful tool (Figure 4).

Fig. 4. The overall report of the results obtained in ZoHo Survey
Source: original data recorded from the research.

It can be seen that the number of responses is written large and central, and on the sides appears the survey publication date and the record date of the last response. On the left vertical black strip, it is distinguished by red that this information is part of the ***Summary*** area. We are more interested in what results from we find in ***Reports***.

In ***Reports,*** we find THE SUMMARY OF RESPONSES and INDIVIDUAL RESPONSES. In the following, we will first present THE SUMMARY OF RESPONSES. In this subchapter, it can be observed the number of answers and the status of complete or not answers, as we find the number of visitors who saw the questionnaire. Our survey of craft beer with the ZoHo Survey showed 67 complete responses, 0 partial responses, and 138 visitors (Figure 5).


Fig. 5. Detailed report of the overall results obtained in the ZoHo Survey
Source: original data recorded from the research.

Given that we chose the free version from the beginning and continue without upgrading to one of the proposed plans, we can only describe that what we can see, in the case of answers, is the ***Default Report***. There are also Custom Report, Cross-Tab Report, and Trend Report variants, but these variants require upgrading. Each question presents both a pie

chart with the percentage responses of the respondents and a table below the graph where the answers for each variant are recorded, with number and percentage (Figure 6).

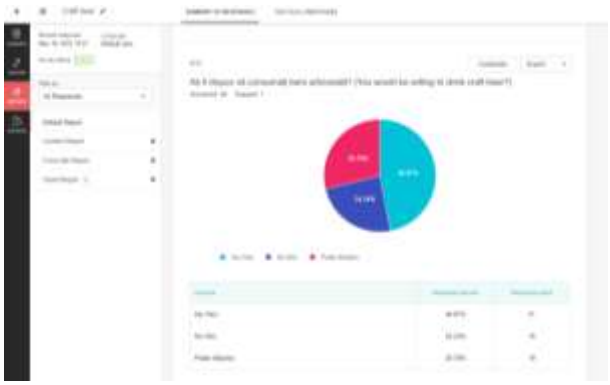

Fig. 6. Detail the answers to each question
Source: original data recorded from the research.

The interesting part is that this tool even offers us a variety of forms in which to take the recorded data. In addition to the default pie chart shape, we can change the chart as a presentation into the following forms:

- Horizontal bar,
- Vertical bar,
- Line chart,
- Arc chart,
- Donut,
- Spider web,
- Area chart,
- Stacked horizontal bar
- Stacked vertical bar.

It is possible to:
-select or not to show the figures in the graph,
-make the label appear only in legend, or label in a chart, or no label, the legend can be positioned up, down, left or right,
-set the data recorded in the table to be visible or not,
-fix how many decimal places to be provided in the report – graph and data table,
-sort how to appear the order of answers represented in the graph: the order was given by us of answers or the original order, alphabetically ascending or descending, by the highest values or by the lowest values (Figure 7).

Fig. 7. Sort how responses appear on the chart at the ZoHo Survey
Source: original data recorded from the research.

Finally, responses can be collected through export. In Figure 6 you can see the existence of an export button on the top right and there you can find two ways to export: As an image and as a pdf. From there it is possible to export all the graphs with related data tables with everything but taking each one and selecting how to export (image or pdf).
Speaking of export, we can't move on without showing that on the left vertical black tape there's an export button. When pressing it we find all the questions with the facility to select them all, in pdf format. However, the free version cannot download all the results by launching an order. It is needed to proceed to download all files manually, to be stored and used as it is needed. The answer to one of the questions received in both png and pdf format and then made the screen-cut to be attached inside the work is presented below (Figure 8).

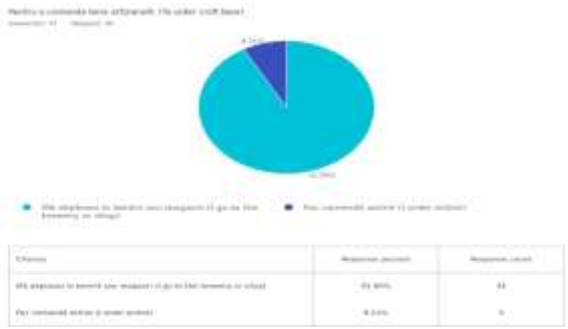

Fig. 8.A. Export responses as an image file with the extension .png
Source: original data recorded from the research.

In the form of an image (Figure 8.A), the exported data appears to have a poorer visibility if we treat them compared to the processed image in the pdf file (Figure 8.B). Either way, the fact that we can process and download the graphs in what form we want is a plus brought by the ZoHo Survey.

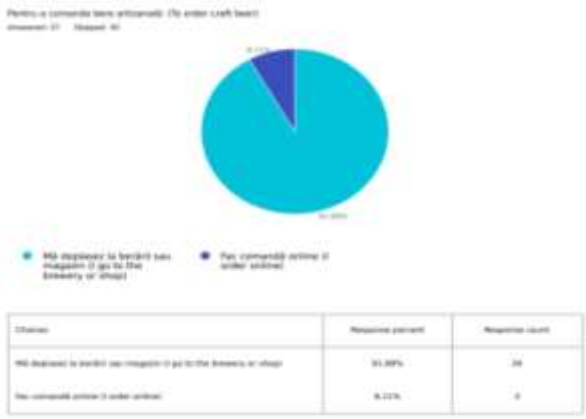

Fig. 8.B. Export replies as pdf file
Source: original data recorded from the research.

At the end of the analysis of the responses received from ZoHo Survey in Figure 9 is shown that in THE INDIVIDUAL RESPONSES window get all the answers given by each respondent.

Fig. 9. Individual responses in the ZoHo Survey
Source: original data recorded from the research.

**Results obtained after the launch of the questionnaire in Survey Monkey**

To gain the answers received in the account opened at Survey Monkey, the first image on the access page is the summary page of the survey results and it looks like in Figure 10.
The following pieces of information are included:

- how many responses are collected,
- the fact that the survey is open, anyone can answer, and
- a global analysis of the survey.

Fig. 10. Number of responses and survey status in Survey Monkey
Source: original data recorded from the research.

If the results are considered weak and it is needed a new targeting of the respondents, a new impetus for gathering a new wave of answers can be made through the collect answers window in Figure 11. At a certain time, if the number of responses does not change, notifications are sent to the mail that we can be helped against a fee to optimize the survey and even further, to increase the number of respondents.

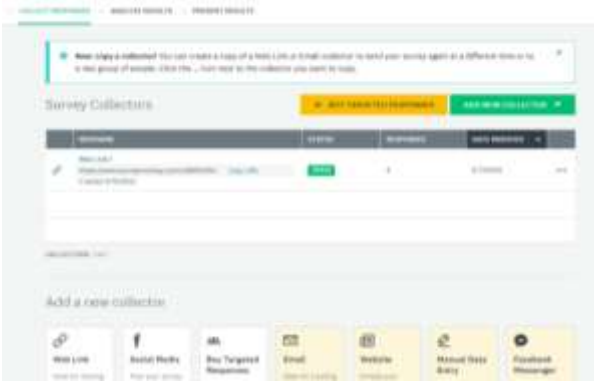

Fig. 11. Proposals from SurveyMonkey to increase the number of respondents
Source: original data recorded from the research.

On the panel of ANALYZE RESULTS, 3 areas provide different information (Figure 12 A and B): ***Questions Summarise***, ***Insights and data trends,*** and ***Individual responses***.
It can be chosen:

- whether to display the received records graphically,
- the shape of the graph,
- colors in the chart,
- the figures on which the graph was built,
- number of the decimal places,
- if the display of the scale is in the form of absolute or relative (%),

- display of data in tabular form.

If the question and the answers given in both graphical and tabular form are observed in detail in the figure, the form of presentation of the graph may be chosen by the one who is collecting the answers, as shown in Figure 12 B. Presentation options of the graph are Horizontal bar, Vertical bar, Stacked Horizontal Bar, Stacked Vertical Bar, Pie Chart, Donut Chart, Line Graph, and Area Graph.

The option to decide whether each graph should be personalized or all graphics to look the same is made available and by pressing the Save button the instruction is given about the desired decision and it is visible into account.

Fig. 12.A. Question and Answer – Chart and Table in SurveyMonkey
Source: original data recorded from the research.

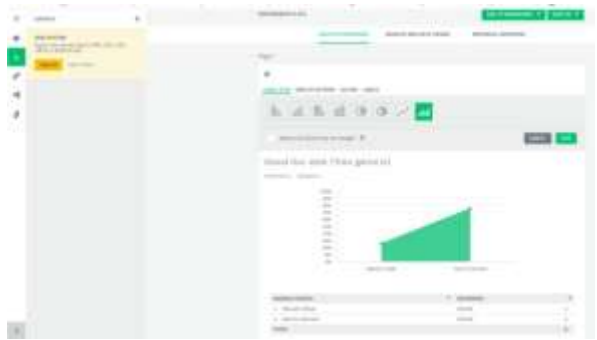

Fig. 12.B. Choosing the type of graph in SurveyMonkey
Source: original data recorded from the research.

For the analysis of statistical significance, however, the free plan is not sufficient, the following financial plans are given as alternatives for these results (Figure 13).

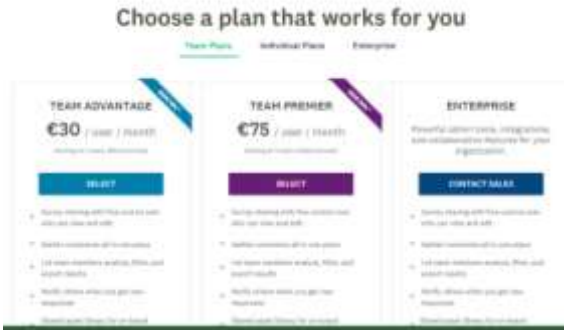


Fig. 13. Financial plans made available for results that include statistical significance in SurveyMonkey
Source: original data recorded from the research.

In the ***Insights and data trends*** area (Figure 14) some data are made available from the less visible part, namely: survey completion rate, the average time spent by a subject to answer the questionnaire, and other information that can be chosen from the existing ones in the survey if someone is interested in the reactions of respondents to a particular question.

Fig. 14. Details about respondents in SurveyMonkey
Source: original data recorded from the research.

It can be seen in the upper left corner of the previous image that only when upgrading the account, it is possible to benefit from exporting data in all kinds of PDF, XLS, PPTX, CSV documents, or even in SPSS format. For a more advanced EXCEL user, upgrading to SPSS format can be bypassed by copying responses and forming pivot tables using them.

The last visible area is ***Individual responses***, which present some very detailed data about the person who completed the survey, time of completion, IP address, and the answer to every question for this person (Figure 15).

Fig. 15. Individual responses collected in SurveyMonkey
Source: original data recorded from the research.

## Comparative analysis of raw data received

Each tool that loaded and launched the opinion poll on the consumption of craft beer gave answers with different characteristics, the only common basis being the choice of the free package.

It would have been the questionnaire itself as a common basis if half of the questions had not been cut for the free package from SurveyMonkey, because here only 10 questions can enter the free package.

As a result of the results displaying differences, which were important in the analysis phase, each feature encountered in the results area was entered into a summary table to be analyzed by comparison and discussed (Table 1).

Table 1. Comparative analysis of responses received using various online tools – free version

| Characteristics | Google Forms | ZoHo Survey | SurveyMonkey |
|---|---|---|---|
| At the opening of the survey | There are 3 areas, the answers area is central and is bounded by the question area and the settings area. | There are 3 areas, the response area is central, it is limited by the date of publication of the survey and the date of the last recorded response. | There are 3 areas, the answer area is on the left side, the center is the status of the survey, and the right of the person to whom the completion notifications are sent. |
| | The number of responses is visible by marking it in a colored circle on the ***Answers*** button. | The number of responses is visible by marking it in a colored circle on the edge. | The number of responses is given in the following type: n total responses/ n visible responses |
| Graphical display | Pie chart | Pie chart – **default**<br>Variations of shape change:<br>Horizontal bar<br>Vertical bar<br>Line chart<br>Arc chart<br>Donut<br>Spider web<br>Arca chart<br>Stacked horizontal bar<br>Stacked vertical bar | Horizontal bar **- default**<br>Variations of shape change:<br>Horizontal bar<br>Vertical bar<br>Pie Chart<br>Donut chart<br>Line graph<br>Area graph<br>Stacked horizontal bar<br>Stacked vertical bar |
| Customize the shape of each graph | No | Yes<br>(Each chart separately) | Yes<br>(Each chart separately or all graphs the same) |
| Set graphic colors | No | No | Yes |
| Change the order of answers in the chart | No | Of choice:<br>-the original order (according to the survey responses)<br>-alphabetically ascending or descending<br>-by the highest or lowest values | Of choice:<br>-the original order<br>-alphabetically ascending or descending |
| Show the number of | Percentage | Percentage | Optional |

| | | | |
|---|---|---|---|
| responses in the graph | Cannot disable, must appear | It is possible to disable the display | It is possible to disable the display |
| Decimal number setting | No | Yes | Yes |
| Display label | Only in legend | It is possible to appear:<br>-in legend<br>-in chart | It is possible to appear:<br>-in legend<br>-in chart |
| Show legend | Yes | Yes | No |
| Position of legend | Cannot be set | At choose:<br>-up<br>-down<br>-left<br>-right | No legend to comment |
| Display the scale | Cannot be set | It can be set in absolute or relative form (%) | It can be set in absolute or relative form (%) |
| Show the number of answers in the table | No | Yes | Yes |
| | | Visibility of choice | Visibility of choice |
| Show individual responses | Yes | Yes | Yes |
| Download results variants (export) | -Each question<br>-Type .csv | -Each question<br>-Format image (.png) and/or .pdf | No |

Source: original data recorded from the research.

## CONCLUSIONS

Over time, opinion polls have become increasingly important due to the diversification of consumer needs and changing consumer preferences.

In the present scientific paper, it is presented a research on how works and what deliverables give several platforms of public opinion polling, with the idea of seeking maximum effect with minimum effort, in other words, to find which platform/instrument dedicated to any entrepreneurship is easier to approach, closer to general search results, and more advisable for those who are at a beginning of carrier, without experience and financial resources.

Each tool that loaded and launched the opinion poll on the consumption of craft beer gave answers with different characteristics, the only common basis being the choice of the free package. Results from Google Forms, ZoHo Survey, and SurveyMonkey were analyzed and compared. The conclusions are presented below:

-comparing these 3 platforms, Google Forms presents results as a pie chart, ZoHo Survey presents results default as a pie chart, but has more types of chart available for chance and MonkeySurvey presents results default as a horizontal bar chart, but also has more types of chart available for chance,

-Google Forms do not allow to customize the shape of each graph, instead, ZoHo Survey and Survey Monkey allow this – even Survey Monkey allows each chart separately or all graphs the same,

-only SurveyMonkey allows setting graphic colors,

-Google Forms is the only one that does not give the possibility to change the order of answers in the chart. On this aspect, ZoHo Survey gives more possibilities even than SurveyMonkey,

-the number of responses is shown in the graph as % and it is not possible to be disabled at Google Forms, instead of at ZoHo Survey and SurveyMonkey can be not displayed,

-the legend is shown only in Google Forms and ZoHo Survey,

-results can be exported question by a question at Google Forms and ZoHo Survey, but cannot be exported at SurveyMonkey. At Google Forms the only way to export is .csv, ZoHo Survey allows a choice of image format as .png and/or .pdf

-only SurveyMonkey limited the survey to 10 questions for the free package.

We have two recommendations for those who want to do market research:

(i)For designing a survey:

-be as brief and exact as you can and donot ask too many questions and keep your

inquiries brief. Long online surveys may turn away potential participants,
-questions from the same topic area that are similar should be grouped,
-avoid using the yes/no question type whenever you can (you are unable to compare different participant perspectives as a result),
-in quantitative surveys, you provide potential answers, such as on a scale from 1 to 10 or multiple-choice questions,
-in qualitative surveys, you ask open-ended questions.
(ii)For those who want to do market research without paying a fee to use the ZoHo Survey tool and for entrepreneurs who can afford to pay for one of the fee packages to use the SurveyMonkey tool.

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# BIRTH RATE IN RURAL AREAS OF BULGARIA FOR THE PERIOD 2011-2021, ACCORDING TO NUTS 1

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***Abstract***

*In the modern Globalized world, the migration movement is accompanied by a population of childbearing age, which in turn gives rise to a geo-demographic birth rate process. The study examines and analyzes the birth rate process on the territory of Bulgaria within the framework of the last two censuses. The aim is to apply a comparative analysis of the process in rural areas related to the results obtained, the deductions and the conclusion, applying the European classification NUTS 1. The research uses the National Methodology for the study of fertility and the application of the fertility rate. The ratio between rural areas during the study period will present the real geo-demographic picture of the country. The study includes the mechanical movement and the birth rate as geodemographic processes in the rural areas of Bulgaria according to the NUTS classification for a certain period of time. In the conclusion, conclusions are drawn based on the analysis and results, and recommendations for a future period of time are also given.*

***Key words*****:** *fertility rate, mechanical growth and classification NUTS*

## INTRODUCTION

The regional development methodology has begun to be imposed as a national priority, regardless of the ongoing changes in global geostrategic - a process affecting Europe and the EU countries. On the other hand, the functional nature of regional development implies a territorial approach to the management of the respective communities, departing from the centralized system. In this regard, the focus on Rural areas (RA) challenges us to solve a series of complex tasks related to the socio-economic and ecological development of these territories. The policy for the development of RA in the EU is dictated by the accompanying factors - approximately 60% of the population of the 27 member countries live in rural areas, covering 90% of the territory of the Community. Rural areas in the EU are diverse in terms of a number of factors: physical-geographical, geopolitical, administrative, ethnic, religious, social, economic, environmental, institutional-technological and others. This variety is one of the largest resources of the above-mentioned within the EU.

In the scientific study the authors accept the national definition, which defines as: "Rural region - the municipalities of (LAU 1), in which there is no settlement (municipality) with a population of more than 30,000 people".

According to this definition, 232 of them are classified as rural, out of a total of 265 municipalities in Bulgaria for 2020. Rural areas cover approximately 82% of the country's territory and 35-38% of its population (Marinov and Mutafov, 2022) [3]. In the last decade, a large part of the RA of the country has been depopulated due to a number of socio-economic, environmental and geopolitical processes. Examining the geo-demographic picture in these areas, the above-mentioned processes must be taken into account, in result of which the dynamics of the population is large and there could be discrepancies with the National Statistics.

The number of the population is a basis on which research, analysis and conclusions can be made about the state of a territory in a

regional or global plan. In the development, the authors consider the number of the population according to the NUTS 1 classification in the RA of the country. Statistical data indicate that for 2011, the population in RA of the country was 2,463,083 people, respectively in Region 1 it was 1,511,400 people or 61.31%. For the same year for Region 2, the population numbered 951,683, or 38.63% of the total. For 2016, the total number of the population in the RA of the country is 2,384,050, which is 33.59% of the same in Bulgaria. At the end of the research period for 2021, there are 2,234,791 people in RA, in Region 1 the population is 1,299,699 people, or 58.15%, for Region 2, there are 935,092 people, or 41.84%.

Geo-demographics considers two types of migration processes: internal and external. The internal processes or Mechanical movement (MM) of the population takes place within the borders of the state between its administrative-territorial units (borders) and populated areas (Slaveikov, 2012) [8]. The process of migration occurs in the directions "village-city", "city-city", "city-village" and "village-village", here can also be counted daily trips for the purpose of work and study, as well as suburbanization as a process (Petrov and Marinov, 2020) [7].

Consequently, with this "displacement" of people of childbearing age in the future, there will be an impact on the birth rate in favor of the large urban centers. Urban areas provide a better standard for the population moving from small administrative centers to large ones. The settlement of a population of childbearing age increases the birth rate in urbanized areas, while proportionally - the process decreases in RA, followed by depopulation of the same territories.

Having children is a biological and social phenomenon, defined as a geodemographic event on a global, regional and local scale. It is a continuous process of development. The birth rate, in turn, is a major component of the natural reproduction of the population. Empirical demographic analyzes indicate that in the fertile period for women aged 15-49 years, they can give birth to an average of 10-12 children. The number of births on the territory of the country, and in particular in RA, according to NUTS 1 classification, is closely related to the number of the population, but provided that the growth is constant, regardless of the minimum and maximum values.

The purpose of the research is to study and analyse the mechanical increase and birth rate in rural areas of Bulgaria based on the NUTS classification for the period 2011-2021, between the two European censuses. Accordingly, after the obtained results, conclusions should be made and recommendations should be made for the geodemographic picture in the rural areas of the country.

## MATERIALS AND METHODS

The scientific development uses the birth rate linked to the population censuses in Bulgaria during the years: 2011, 2016 and 2021. The starting year coincides with the first joint census of the EU countries and, accordingly, the last one up to this stage. An interim year from the national annual population census is also indicated for reliability and a basis for comparison.

The purpose of the study is to track the birth rate in the RA of Bulgaria based on the NUTS 1 classification, statistics and the Law on Regional Development in force from 31.08.2008, State Gazette No 50 of May 30, 2008, amended SG., No 21 of March 13, 2020, Chapter Two - Territorial basis of regional development, Art. 4. (2), (suppl. - SG No 21/20, in force from 13.03.2020).

The birth rate is measured in per mile (‰), indicating the total number of live births in the respective year for every 1 000 people of the average annual population of the previous year:

$$BR = (LB / PC) * G \quad (1)$$

where:
BR – Birth rate
LB – Live births during the study period
PC – Number of population of the country (region)

G – Coefficient per thousand (‰).

The research used the European NUTS classification, Bulgaria's Law on Regional Development, statistical information from the National Statistical Institute on the number of the population at the regional and national level, mechanical growth, geodemographic methodology for calculating the number of the population, comparative and mathematical analyzes and the authors' own calculations, based on the collected information (Mutafov and Marinov, 2022) [5]. The scientific research is applicable, through a comparative analysis, between EU member states using the NUTS classification, it is also applicable to smaller administrative-territorial units of the same. Microsoft Word and Excel were used in the development of the scientific material.

## RESULTS AND DISCUSSIONS

Internal Mechanical movements (MM) in the RA of Bulgaria include: settlements, emigrations and Mechanical growth (MG) as well as various types of socio-economic, environmental and other processes caused by the need for better education, work and raising the living status (Markov, 2018) [4]. In the scientific development, MM has been analyzed, as part of the geodemographic process from MG within the specified years, as an indirect geodemographic process in the RA of the country and in particular, according to the NUTS 1 classification, having an impact on the birth rate based on a population of childbearing age. The methodology is based on the MM (number of people) of the population in the RA of the country (Marinov, 2022) [2] in the specific case, region 1 - "Northern and South Eastern Bulgaria" for 2011, the MG increase for the entire territory reports a positive balance of 113 persons, and in the following year 2016, the values are negative - minus 6,417 persons, and for 2021, the indicators are again negative - minus 707 persons. For the region 2 - "Southwest and South Central Bulgaria" for 2011, the MG reports negative values - minus 902 persons. In the following year, 2016, the MG reports minus 4,446 persons again and for 2021, a geodemographic analysis for the MG indicates minus 132 persons.

In Fig. 1 Mechanical growth in RA and NUTS 1, period 2011 – 2021, the population change is visualized during the study period, in number of people for the indicated areas.

Mechanical growth is a geodemographic indicator in which the "main participants" are mostly of childbearing age and their "movement" from one space to another has a direct impact on the birth rate and population size.

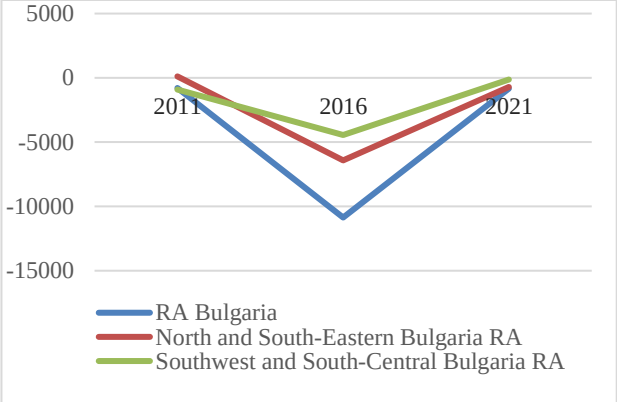



Fig. 1. Mechanical growth (number) in RA and NUTS 1, period 2011 - 2021.
Source: Own research and National Statistical Institute [6].

In this case, during the study in the RA, according to the NUTS 1 classification, during the entire research period 2011-2021, the MG has negative values, for the country, the analysis reports an average value of minus 1,418 persons, for the RA during the same period it is minus 12,491 persons. With average values of the MG during the research period 2011-2021 for "Region 1", the analysis indicates that the MG compared to that of RA per country constitutes 56.12%, while for "Region 2", in the same period the values are 43.78%.

Birth as a process is largely associated with the age structure of the population. According to the age structure scale created by the Swedish demographer Gustav Sundberg (1857-1914) [9], the authors determine that the type of age structure for RA in NUTS 1 is a Regressive type - the proportion of ancestors exceeds that of children. This is related to the slow generational change due to the longer

life duration and the accumulation of many generations. The regressive type is accompanied by zero or negative natural growth. The age structure predetermines narrowed natural reproduction, where the number of children in the family is less than 2 - the population decreases in number, each subsequent generation is smaller. From the empirical study, the authors adopt - Modern type of reproduction for RA according to the NUTS 1 classification (applied to both regions). It is characterized by the slow change of generations of parents and children. This is due to relatively low birth and death rates and longer life expectancy, as well as the large proportion of a migrating population of childbearing age.

In Table 1, live births are visualized by year in the RA of the country and by NUTS 1,in thousands, the numerical values of the studied areas are presented [6].

Table 1 presents live births in the period 2011-2021, for the country and the two regions indicated in the study. For 2011, the population number of the country was 7,364,570 for the RA it was 2,798,536, live births in Bulgaria were 70,846 of which 23,957 lived in the RA or in a percentage ratio to the total figure they were 33.82%.

Table 1. Live births by years in the RA of the country and by NUTS 1 (number)

| District | Years | | |
|---|---|---|---|
| | 2011 | 2016 | 2021 |
| Bulgaria RA | 23,957 | 21,882 | 19,540 |
| North and South-Eastern Bulgaria RA | 14,697 | 13,113 | 11,444 |
| Southwest and South-Central Bulgaria RA | 9,260 | 8,769 | 8,096 |

Source: [6].

In 2016, as a pure statistic, the number of the population from the previous year of research in the country decreased to 7,101,859 or by 3.70%. Accordingly, there is a decrease in the same amount in RA - 2,378,512 or by 17.66% from the previous period. Live births in the indicated year for the country were 64,984, while in the RA for the same year there were 21,882 (9.48% decrease from the previous period) or 33.67% of them.

The last stage of the study includes the year 2021, as the population for the country is 6,519,789, compared to the initial period, it has decreased by 12.96% within ten years, correspondingly, there is also a decrease in the population in RA of 2,477,519 people, by 321,017, 12.95%. There were 58,678 live births in the country this year, 19,540 of them in the RA, or 33.30% of the same. From the initial to the final stage of the study, the live births in the RA of the country decreased by 4 417, or by 18.44% over a ten-year period.

For the RA of North and Southeast Bulgaria during the study period, the birth rate moved in a downward direction. In 2011, the total number of births was 14,697 or 61.35% of the process in the RA of the country. For the interim year 2016, the statistics report 13,113 people's births, a decrease of 1,584 peoples or 10.77% from the previous period. The births in "Region 1" referred to the general statistics for RA of the same year constitute 59.93%. At the end of the study for 2021, within ten years, the decline in births was 22.13%.

For the RA of Southwest and South-Central Bulgaria, the number of births is less according the classification. In 2011, the statistics reported 9,260 people's births or 38.65% of the total number of births in the RA of the country. For the interim year 2016, a decrease from the previous year by 491 peoples or 5.30%, is also reported. For the same year in "Region 2", when analyzing the numerical values, there is a minimal growth of 1.42% when comparing the births with those of the total number for RA with the previous year. At the end of the study, for the ten-year period, the drop in births was 12.57%, constituting 41.43% of the total process in RA (Yankov, 2014) [10].

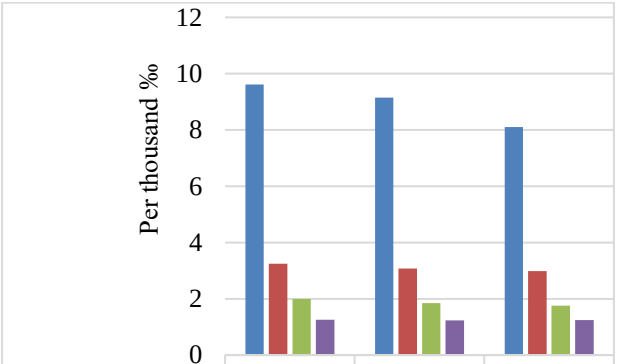
The study presents in Figure the births during the specified period, by years, on the territory of the country; RA in the same, as well as the statistical sample for the regions, according to NUTS 1.

Births are defined as a geodemographic process on a regional and global scale and affect the majority of the population of childbearing age. On the other hand, the birth

rate is a major component in the natural increase of the population and the change of generations.

Figure visualizes the birth rate process on the territory of the country, RA and regions according to NUTS 1 classification (Yankov, 2016) [11].

For Bulgaria, in 2011, live births were 9.61‰, in the following ten years, the process reports a drop within 1.51‰, which corresponds to a reduced total number of the population in the country. In the RA in the period 2011-2021, births also decreased with a minimum rate of 0.26‰.




| | 2011 | 2016 | 2021 |
|---|---|---|---|
| Bulgaria | 9.61 | 9.15 | 8.1 |
| RA Bulgaria | 3.25 | 3.08 | 2.99 |
| North and South-Eastern Bulgaria RA | 1.99 | 1.85 | 1.76 |
| Southwest and South-Central Bulgaria RA | 1.26 | 1.23 | 1.24 |

Fig. 2. Live births in the RA of the country and according to NUTS 1, at (‰)

Source: Own research and National Statistical Institute [6].

The same trend is maintained at the "Region 1" level within ten years - of 0.23‰, or the numerical values of decrease are approaching those at the national level. For "Region 2" again, for the same period of ten years, there is a minimal drop of 0.02‰, births maintain a constant position.

The main reason is that in this Region located the two largest urban areas and smaller administratively gravitating to them territories, with a well-developed socio-economic infrastructure.

## CONCLUSIONS

The research and analysis of the RA in the EU and in particular in Bulgaria, based on the NUTS classification from Geodemographic and Geopolitical point of view of, has a strategic importance - the migration of the population is tracked, the ethnic and religious affiliations have been studied. The number of the population in the RA by region is decreasing, within ten years there is a decrease of 14%, the main reasons are the high migration, the low average life expectancy in these regions and, last but not least, the inadequate policy on the part of the rulers (Yankov, 2019) [12]. In the research study, the authors dwell on the MG, which, according to them, is basic for the development of a certain territory, increasing the number of births, increasing the number of the workforce, increasing the GVA. The mechanical growth during the study period in both regions has negative values, which leads to the depopulation of territories in which there are no "visible" reasons for this phenomenon. Analyzing the territory of the country according to NUTS 1 classification, the authors "conditionally" divide the space and compare the process of Birth rate, which is the basis of the socio-economic development process. The decline of this geodemographic process is obvious, smooth with negative values in the study period. In “Region 2”, a slight decrease of 0.02‰ is reported within the study. The process is reversible, through the implementation of protectionist policies by those in power in the following decades.

## ACKNOWLEDGEMENTS

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# INDEX OF LOCATION OF EMPLOYED PERSONS AND PART OF NON-AGRICULTURAL ACTIVITIES IN THE RURAL AREAS OF SOUTH CENTRAL BULGARIA (IN THE CONTEXT OF SOUTH-CENTRAL REGION)

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***Abstract***

*Rural areas with specific socio-economic activities within the EU RDP, and in particular for Bulgaria, are the main subject in the above-mentioned program in the new framework period 2021-2027. The study examines part of the non-agricultural activities in the field of Services - Hotel and restaurant business (I), Construction (F) and Transport, warehousing and post offices (H) in the South-Central Region (SCR). A deductive, comparative method is applied, as well as an Index of localization (IL), including: enterprises, number of labor units working in the relevant subsector. An analysis is made of the derived location index, comparing the different activities to the considered territories according to the NUTS classification. The conclusions and generalizations are based on the results obtained and their relation to the EU CAP.*

***Key words*****:** *location index, rural area, non-agricultural activities, district.*

## INTRODUCTION

Integration is a process that develops not only in a certain country or state, but covers large geographical areas in a global aspect (Bashev 2017) [1]. The need to create an integrated society leads to the formation of various unions or associations based on political or economic interests. Regional integration applies under certain conditions imposed by the object to the subject. Rural areas (RA) in the SCR are characterized by a specific natural resource and socio-economic potential (Bashev, 2022) [2]. On this basis have been built the research, analysis and conclusions related to the sub-sectors of non-agricultural activities: Hotel and restaurant industry, Construction and Transport, warehousing and post offices, as a part of the sphere of Services.

In the scientific study the authors accept the national definition, which defines as "Rural areas - the municipalities of (LAU 1)in which there is not a settlement (municipality) with a population of more than 30,000 people". According to this definition, 232 of them are classified as rural, out of a total of 265 municipalities in Bulgaria for 2020. Rural areas cover approximately 82% of the country's territory and 35-38% of the country's population (Mutafov and Marinov, 2022) [12].

From the last two national censuses, related to the general European census, the statistical data indicate that for 2011, the population in RA of the country was 2,463,083persons, respectively in Region 1 it was 1 511 400 or 61.31%. For the same year for Region 2, the population numbered 951,683, or 38.63% of the total (Markov, 2019) [8].

For 2021, there are 2 234 791 peoples in RA, in Region 1 the population's number is 1,299,699 peoples, or 58.15%; for Region 2 there are 935,092 persons, or 41.84% (National Statistical Institute- NSI) [13].

In Table 1, RAs are presented, divided by districts corresponding to the National definition of the same. The research covers a period of ten years, meeting the requirements for scientific study.

Table 1. Population in Rural areas by districts from South Central Region

| DISTRICT | 2010 | 2015 | 2020 |
|---|---|---|---|
| DistrictKardzhali | 85,165 | 83,700 | 89,461 |
| DistrictPazardzhik | 126,122 | 118,817 | 95,346 |
| DistrictPlovdiv | 230,386 | 219,407 | 216,756 |
| DistrictSmolyan | 80,019 | 73,329 | 66,599 |
| DistrictHaskovo | 101,529 | 97,195 | 93,113 |

Source: NSI and author's calculations [13].

The main role of the scientific research in this publication is to present the socio-economic picture in RA of the SCR, focusing on non-agricultural activities, which are related to the number of the population in the mentioned municipalities. Employment and enterprises, which in turn form GVA, which is part of the country's GDP, and all of this determines the socio-economic status of the population in these territories (Kolaj et al., 2021) [5]. Table 1 shows the number of the population by districts in the RA of the same for a period of ten years. For the five mentioned districts, as part of the SCR, it can be seen that the population in RA decreased from the beginning to the end of the period, with the exception of Kardzhali district, where there is an increase by 4.75%. Non-agricultural activities in the RA are subject to the CAP of EU and Bulgaria, as a member of this Union, must take into account the political situation (Krustev and Fidanska, 2022) [6].

## MATERIALS AND METHODS

In the research study have been analyzed part of the non-agricultural activities - Hotel and restaurant sub-sector (I), Construction (F) and Transport, warehousing and post offices (H), as a part of the sphere of Services in the RA of the SCR, based on: Classification of economic activities (CEA) of 2008 [3], EC Regulation № 1893/2006 of the European Parliament and of the Council of 20.12.2006 - to establish a statistical classification of economic activities NACE Rev. 2, and to amend Regulation (EEC) №3037/90 of the Council, as well as some regulations (EC), regarding specific statistical areas at the regional level for the member countries. In the publication I refer to Section II, Art. (9 to 21) and Appendix I and II of the above CEA (CEA, 2008) [3].

The purpose of the research is to reveal part of the non-agricultural activities in the field of Services – (Hotel and restaurant sub-sector - I, Construction - F and Transport, warehousing and post offices - H) in RA of the SCR. During the research, using the statistical information for the region, administrative centers and settlements with a population of more than 30 000 peoples were removed, leaving only rural municipalities (Milusheva, 2012) [10]. They are related to the socio-economic activities of this type of administrative-territorial units, bound by the law on Regional Development inforce from 31.08.2008, State Gazette No 50 of May 30, 2008, amended SG., No 21 of March 13, 2020, Chapter Two - Territorial basis of regional development, Art. 4. (2), (4) and (5), (suppl. - SG No 21/20, in force from 13.03.2020), (Law of regional Development, 2008) [7].

The Index of Localization (IL), applied in the study, is a basic indicator (Isard et al., 1988) [4] that serves to compare regions, rural areas, municipalities and settlements according to the main, regional socio-economic activities for the same to the country. When using IL for a sector, sub-sector, production, employed persons in a given administrative-territorial unit and it is bigger than 1 (unit), at a basic indicator for the country as a whole, then the production (activity) of the industry has a higher concentration in the region or municipality, which is an indicator of localization of the relevant economic or social activity. With a coefficient less than 1 (unit) in the respective territory, localization processes are absent or there is a small concentration of sectors, sub-sectors, productions and employed persons. The use of the economic indicator IL can be tied to the number of the population of a certain territory, employed persons in various types of industries, sub-industries in production activities (specifically for the

population of working age). The following formula is used to calculate IL:

**IL = (Sj / Nj) / (S / N) = (Sj / S) / (Nj / N)**

.....(1)

where:

IL –Index of localization

Sj – the number of employed persons/enterprises in the sector j in the region

S – the number of employed persons/enterprises in the processing industry in the area

Nj– the number of employed persons/enterprises in the sector j in the country

N – the number of persons/enterprises employed in the processing industry in the country.

The research used the European NUTS classification, the definition of Rural Areas corresponding to the country, the National Statistics Office of Bulgaria, statistical information from the National Statistical Institute on the number of non-financial enterprises and employed persons for a period of ten years - 2010, 2015 and 2020, according to the CEA. The research is applicable, using a comparative analysis between the EU when using the NUTS classification also for smaller administrative-territorial units of the same. Microsoft Word and Excel were used in the research and analysis of statistical information.

Note* The Index of Localization formula base model presented by Walter Isard for this study has been adapted to publishers' requirements. The study is based on the indicated number of Rural Municipalities (232), before the adoption of the Strategic Plan for the Development of Agriculture and Rural Areas of the Republic of Bulgaria for the period 2023-2027.

## RESULTS AND DISCUSSIONS

In the scientific publication, I have examined the employed persons and non-financial enterprises in the RA by regions of the SCR for a period of ten years. I have analyzed the subsectors - Hotel and restaurant industry (I), Construction (F) and Transport, warehousing and post offices (H), which are in the sphere of the Services sector for the territory of the country. The final result of IL, visualized in figures, indicates the years and the territories considered above. In Figure 1, the IL of persons employed in a sub-sector is presented - Hotel and restaurant industry (I).

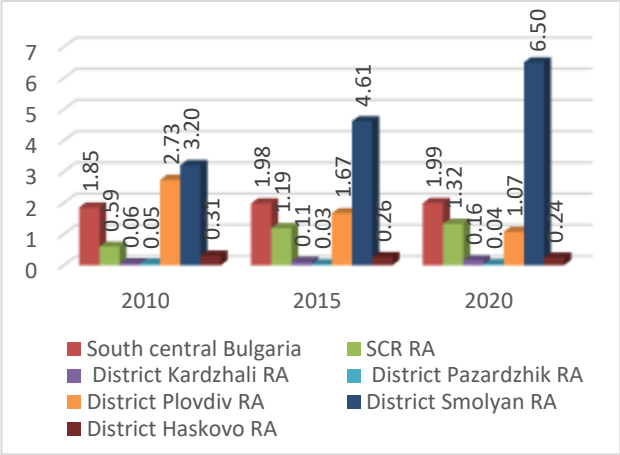


Fig. 1. Employed persons under CEA – I by Regions for RA by IL for Bulgaria

Source: NSI and author's calculations [13].

The analysis of IL in Figure 1 reveals that there is the highest localization of I in the RA of Smolyan region for the entire study period. According to the IL for employed persons in the RA of Plovdiv region, they occupy a smaller concentration in the sub-sector - I and both territories have an indicator above 1. In South Central Bulgaria, related to the country, IL is above one for the entire period of research, there is a specialization in sub-sector I. Rural municipalities in the SCR, throughout the study period report an index above 1, the territory has a specialization in this sub-sector. With values below one are the RAs of Pazardzhik, Haskovo and Kardzhali districts.

The Index of localization for non-financial enterprises during the research period reports a specialization above one in sub-sector - I for South Central Bulgaria, relative to the country.

From RA by districts with an index above one are Smolyan and Plovdiv, and in 2010, the latter surpassed the former with an index of 0.49. In the following years, there is an equalization and overtaking in the localization of non-financial enterprises in I.

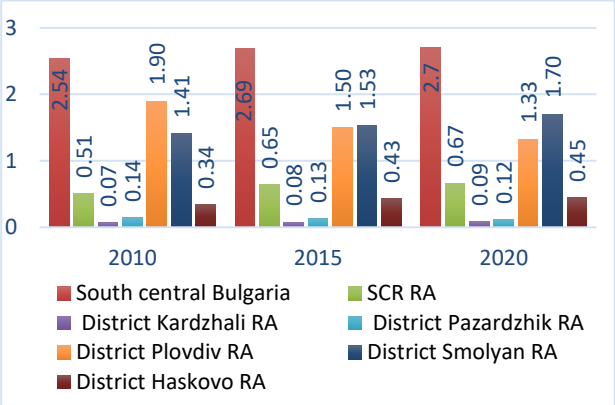


Fig. 2. Non-financial enterprises under CEA – I by Regions for RA under IL for BG
Source: NSI and author's calculations [13].

For the RA of the SCR during the study period, IL reports values below one compared to the country at the end of the period, there is an increase of 0.16 index (Yankov, 2016) [17]. The rest of the RAs in Pazardzhik, Kardjali and Haskovo districts are under one, they have minimal localization of this type of non-financial enterprises from the sub-sector - I.

The following Figures (3 and 4) present the employed persons and non-financial enterprises from the sub-sector - Construction, part of the sphere of Services in Bulgaria for a period of ten years in the RA by regions of the SCR and the country.

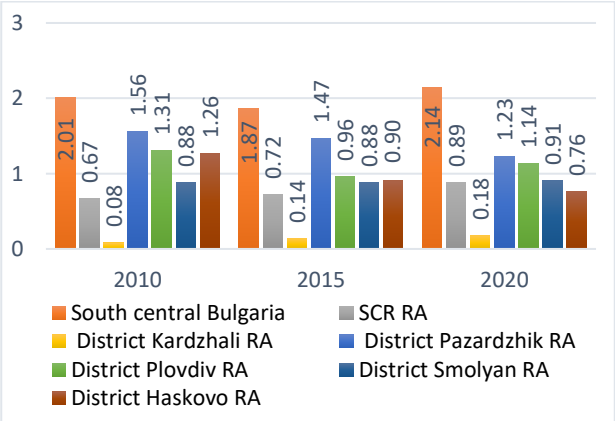


Fig. 3. Employed persons under CEA – F by Regions for RA by ILfor Bulgaria
Source: NSI and author's calculations [13].

Analysis of IL in Figure 3 reveals that there is the highest localization of employed persons with values above one in sub-sector - F for South Central Bulgaria, during the study period. For RA of the SCR, IL has values minimally close to one (Sarov, 2021) [14]. The rural municipalities of Pazardzhik district in sub-sector F are the leaders in IL for the entire research period with a value above one. Followed by RA of Plovdiv district, reporting IL above one for the ten years. For the above two areas for sub-sector – F, the index indicates that there is specialization and concentration of employed persons. The RAs of Haskovo and Smolyan districts follow with values close to one. The rural municipalities of Kardzhali region have minimal IL for the above-mentioned sub-sector during the research period.

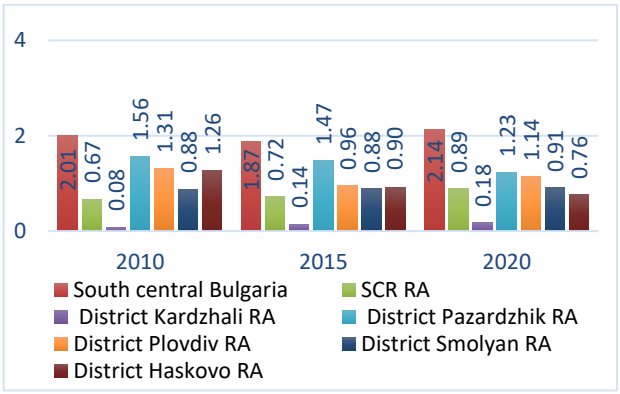


Fig. 4. Non-financial enterprises under CEA – F by Regions for RA under IL for BG
Source: NSI and author's calculations [13].

The Index localization for non-financial enterprises during the research period reports specialization above one in sub-sector – F, South Central Bulgaria. In the rural municipalities of the SCR, IL reports values slightly below one. From RA in areas with high localization of non-financial enterprises is Pazardzhik and Plovdiv, above one for the entire research period. RA of Smolyan and Haskovo districts, IL reported values slightly below one. The RAs of Kardzhali region have a low localization index below one for – F.

The statistical information refracted through IL is visualized in Figures (5 and 6), employed persons and non-financial enterprises from the sub-sector – Transport, warehousing and posts (H), part of the sphere of Services in Bulgaria for a period of ten years in the RA by regions of the SCR and the country.

Analysis of the IL in Figure 5 reveals that the highest localization of employed persons with

values above one is in the sub-sector - Transport, warehousing and post (H), for the RA of Plovdiv region throughout the study period, with values approaching at the end index five.

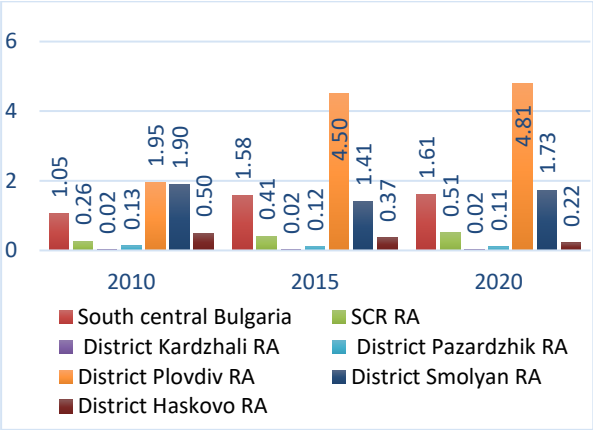


Fig. 5. Employed persons under CEA – H by Regions for RA by ILfor Bulgaria
Source: NSI and author's calculations [13].

Followed by RA of Smolyan region with values above one, throughout the entire period. South Central Bulgaria reports an IL above 1 relative to the country for the entire period, which indicates concentration and specialization in this sub-sector in the field of Services. For the rural municipalities of the area, as a whole, IL is below one compared to the country, during the ten years of study. For the remaining RA of the districts of Kardzhali, Pazardzhik andHaskovo, IL for sub-sector – H reports low values below one.

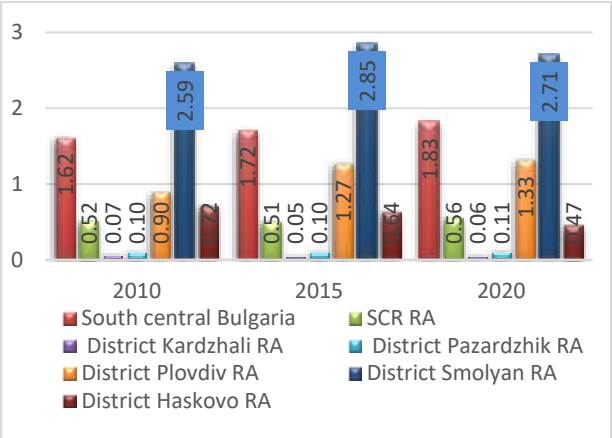


Fig. 6. Non-financial enterprises under CEA – H by Regions for RA under IL for BG
Source: NSI and author's calculations [13].

The Index localization of non-financial enterprises during the research period shows specialization above 2 in sub-sector – H for RA of Smolyan region, strong concentration and localization of this type of activities. They are followed by RA of Plovdiv region with an index above one. South Central Bulgaria has a localization of these services, with IL above one, compared to that of the country during the study period. The rural municipalities of the region report a low specialization of this type of service, below one (Tsvyatkova, 2021) [16]. For the remaining RA of the districts of Kardzhali, Pazardzhik andHaskovo, IL for sub-sector – H reports low values below one, for non-financial enterprises.

## CONCLUSIONS

The Hotel and restaurant sub-sector (I) on the territory of the SCR reports a high localization for employed persons and non-financial enterprises, based on socio-economic and natural conditions. The rural municipalities of the Smolyan region locate the socio-economic indices mentioned above, related to the fact that the territory is entirely mountainous and activities related to tourism are developed. RA of Plovdiv region localize this type of activity on the basis of developed tourist infrastructure and the proximity of urbanized areas to RA (Mihailova, ets, 2022) [9]. For Pazardzhik, the accounting of the low localization of employed persons in sub-sector I is lack of municipalities with intense touristic activities but not meeting certain factors from the definition of RA (e.g., Velingrad municipality). The definition of RA, which was adopted for Bulgaria, does not cover a large part of the territories, which are municipalities or villages (e.g. the village of Yagodovo, Plovdiv municipality) meeting the socio-economic profile for such.
Construction (F) has its base for IL – proximity to large urbanized centers, with employment in the RA sub-sector moving from the periphery to the center. South Central Bulgaria, compared to the country, has a high concentration of employed persons, due to the large number of RAs and several highly urbanized centers where permanent

construction activities are carried out. Compared to the country, the RAs of the SCR have a specialization of employed persons and non-financial enterprises in sub-sector F. The RAs of the regions: Smolyan, Pazardzhik and Plovdiv have the highest share of localization. The migration flow from the city to RA creates conditions for the construction of new homes, which creates new jobs and enterprises engaged in this type of activity (Yarkova and Mutafov, 2017) [18].Transport, warehousing and post offices (H) is the sub-sector serving the previous two and is largely related to the socio-economic activities of the Services sector in the SCR as a whole. Employed persons and non-financial enterprises are located in RA of Plovdiv region, due to the proximity of a large urbanized center. On the other hand, IL for RA of Smolyan region for this sub-sector also reports a high localization of employed persons and non-financial enterprises, due to the resort activity of the region, in general. RA of Pazardzhik region report a high concentration of employed persons and non-financial enterprises in this sub-sector, due to its geographical location between the two largest cities in the country and the proximity to cultural and tourist sites. From a total of five districts and their RAs with the lowest values of IL for the three subsectors and their indices - employed persons and non-financial enterprises, the RA of Kardzhali district stands out. On the other hand, this is the area where there is an increase in population within the studied period (Sarov and Tsvyatkova, 2020) [15]. The reasons are socio-economic lack of investment and initiative on the part of the population, poor administrative management and others. In the study of the other sectors and sub-sectors, the results will probably be different, general conclusions should not be made for one territory based on the analysis of several sub-sectors (Mutafov, 2021) [11]. The rural areas of the SCR have a huge potential to develop in all socio-economic and environmental directions on the basis of: geographical and geopolitical location, availability of natural resources (conventional and alternative), traditions of the population, ethnic and religious tolerance, numerous secondary schools and universities and last but not least, all these must be brought together by the state in the form of Protectionism.

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# OPPORTUNITY FOR INCREASING THE PRODUCTION OF RUMINANTS, SUCH AS CATTLE, BUFFALOES, SHEEP AND GOATS IN THE FOOT-HILL AND MOUNTAIN REGIONS OF BULGARIA

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***Abstract***

*This paper investigates the current state of production from cattle, buffaloes, sheep and goats in the hilly, foot-hilly and mountain regions of Bulgaria, as well as the opportunities for its increase. Negative trend were observed in the populations of cattle, sheep and goats in the last two decades. 634,466 cattle were raised in Bulgaria in 2001, 371,901 of which were dairy cows. Data for 2020 showed values of 568,700 heads of cattle, 365,500 of which were dairy cows and pregnant heifers. In this period, the number of sheep decreased from 1,571,410 in 2001 to 1,307,800 in 2020, and the decline in goats was even more noticeable, from 675,292 in 2001 to 253,400 in 2020. The decline in the breeding of farm animals led to a decrease in the volume of animal milk and meat products. For the positive development of the volume of agricultural production in the foot-hilly and mountain regions of Bulgaria, decisions are needed to improve the gene pool, health care, feeding, as well as the application of advanced modern technologies. The advantage of mountain and foot-hilly agriculture is in the creation of high-quality food products and for this reason it is necessary to support it through appropriate measures and programs.*

***Key words*****:** *meat, milk ,production, ruminants, trends*

## INTRODUCTION

The natural features of Bulgaria, which include a hilly and mountain relief, as well as centuries-old cultural traditions lead to the fact that a significant part of the population is engaged in raising cattle, buffaloes, sheep and goats. Animal husbandry has a significant role in Bulgarian economy, providing both food and income for households. Ruminants including cattle, buffaloes, sheep and goats are a particularly essential source of meat, milk and wool in the foot-hilly and mountain regions of Bulgaria. However, the production of these animals in these regions is often limited by various challenges such as limited access to markets, poor infrastructure and harsh climatic conditions (Ružić et al., 2002; Markov, 2014) [12, 8].

Despite these challenges, opportunities exist to increase ruminant production in foot-hilly and mountain regions by adopting improved management practices and technologies (Nikolova, 2020) [10]. The gross added value from the agricultural sector in 2020 is in the amount of 4,205 million BGN at current prices, which is equal to 4%.

The structure of the value of gross production from the agricultural sector shows that animal husbandry occupies 24.61% of it (Agrostatistics - Survey Number of livestock in Bulgaria, 2021) [2].

The aim of the present study is to identify and evaluate the opportunities for increasing the production of ruminant animals, such as cattle, buffaloes, sheep and goats in the foot-hilly and mountain regions of Bulgaria, by proposing improved management practices and technologies.

## MATERIALS AND METHODS

The investigation is based on an analysis of scientific developments and concepts related to the number and production obtained from ruminants. As a methodological basis for conducting the study, general scientific research methods, information-logical analysis of scientific and scientific-practical information, as well as materials for marketing research on the market of various

breeds of cattle, buffaloes, sheep and goats were used. Descriptive and retrospective analysis were also applied. To achieve the aim, aggregate data were used concerning Bulgarian, European and worldwide cattle breeding, buffalo breeding, sheep breeding and goat breeding in the period 2001-2021. The information used is mainly referred to publications of FAO, Ministry of Agriculture, Food and Forestry, Customs Agency, Department of Agrostatistics, agricultural and marketing reports and market analyses, as well as the paper quotes pieces referred to the research works of Bulgarian and foreign authors. Summaries are made and conclusions are drawn, and data are presented in a table and a figure.

## RESULTS AND DISCUSSIONS

### I. State of ruminant animal husbandry in Bulgaria – number and percentage change over a period of 20 years

The data analysis indicated in Table 1 shows permanent tendency for decrease in the number of ruminants, such as cattle, buffaloes, sheep and goats in Bulgaria. A progressive increase is registered only in the buffaloes, which were 6,529 in 2001 and reached 20,200, or an increase of 309.4%.

Table 1. State of animal husbandry in Bulgaria

| Year | Cattle | Buffaloes | Sheep | Goats |
|---|---|---|---|---|
| 2001 | 634,466 | 6,529 | 1,571,410 | 675,292 |
| Percentage change compared to 2001 | 100% | 100% | 100% | 100% |
| 2005 | 621,797 | 7,973 | 1,602,255 | 608,426 |
| Percentage change compared 2001 | 98% | 122.1% | 102.0% | 90.1% |
| 2008 | 564,904 | 8,968 | 1,474,845 | 429,834 |
| Percentage change compared 2001 | 89% | 137.4% | 93.9% | 63.7% |
| 2014 | 552,807 | 9,555 | 1,109,047 | 292,644 |
| Percentage change compared 2001 | 87.1% | 146.3 % | 70.6 % | 43.3 % |
| 2017 | 540,115 | 12,809 | 1,316,784 | 256,967 |
| Percentage change compared to 2001 | 85.1% | 196.2% | 83.8% | 38.1 |
| 2020 | 568,700 | 20,200 | 1,307,800 | 253,400 |
| Percentage change compared to 2001 | 89.6% | 309.4% | 83.2% | 37.5% |

Source: Agrostatistical reference book 2000 – 2017, Agrostatistics Department - Survey Number of livestock in Bulgaria as of 1st November 2020 [1].

The decrease for the twenty-year period in cattle was by 65,766 heads or 10.4%, in sheep it was by 153,610 or 16.8%, and in goats – by 421,892 or 62.5%. 5%.

### II. Breeds

Intensive dairy cattle breeding necessitates the use of new breeds for Bulgaria. Nowadays, the share of Bulgarian Black-and-White cattle is about 55%.Montbeliarde and Simmental breeds are also used in dairy cattle breeding, and to lesser extent Bulgarian Rhodopean Cattle, Bulgarian Brown cattle, Brown American cattle, Ayrshire and Normande cattle. The following meat-producing breeds are bred: Aberdeen Angus, Hornless Hereford Limousin, Blonde d'Aquitaine, Galloway and Gascon cattle. There are found 100,000 purebred beef cattle, while the raised meat crossings range from 25,000 to 35,000. The indigenous breeds, such as Bulgarian Gray Cattle and Rhodopean Short-horned Cattle are also bred (Markov, 2014) [8].

Bulgarian Murra breed is the only representative breed of buffaloes (Angelov et al., 2007) [4].

The following sheep breeds are taken into consideration in dairy sheep breeding: Asaf, Lacaune, Awassi, Black-headed Pleven sheep and Synthetic population Bulgarian dairy sheep, and in meat sheep breeding the following: Ile de France and Mouton-Charollais. The specific breeds of Tsigai, Rhodope Tsigai and Romanov sheep are bred in the mountain and foot-hillyregions. There are also represented 16 local indigenous sheep breeds (Tyankov et al., 2002) [15].

Dairy goat breeding is represented by Bulgarian White Dairy goat, Togenbur goat and Anglo-Nubian goat. Meat goat farming is represented by Boer breed. Kalofer long-

haired autochthonous goats are also bred (Tyankov et al., 2002) [15].

**III. Climate, relief, pastures and grass communities**

The climate in Bulgaria is moderately continental. The terrain is mostly hilly and mountainous. The total area of pastures in the world represents 26% of the land area. According to data from the Department of Agrostatistics in Bulgaria, over 1,000,000 ha of herbaceous areas are available in plains and foot-hills of the country, and about 130,000 ha in mountain regions (Agrostatistics Department, Survey of land cover and land use in Bulgaria (BANCIK), 2018) [3]. Grass communities (herbaceous) are an important forage resource but they are still undeveloped. Grass stands are natural, secondary formed on the site of abandoned cultivated areas, and they depend on their origin, while the artificial grass stands are created for the purpose of intensive use.

Grazing is a practical measure to restore the biological balance. Pasture load is a measure of the amount of vegetation being grazed by a given number of animals. Mowing and trimming are management methods and the corresponding grass communities are used for hay production. It concerns certain steps such as: mowing period, mowing range, mowing frequency, obtained mass as a result (Tsonev& Gusev, 2017) [16].

**IV. Milk production**

In 2020, a total of 975,810 l of milk was produced in Bulgaria. That includes cow milk – 856,081 l, buffalo milk – 15,435 l, sheep milk – 73,897 l and goat milk – 30,397 l. Compared to 2001, when a total of 1,016,565 l was produced in the country, which is negative difference of -40,755.5 l. That includes: cow milk – 826,901 l, or positive difference of +29,281 l; buffalo milk 32,246 l, or negative difference of 16,811 l; sheep milk – 69,614 l or positive difference of +4,238 l; and goat milk – 87,804 l, or negative difference of -57,406 l. Such data can be explained by the progressive decrease in the number of animals and the slowly increasing average productivity (Agrostatistical reference book 2000 – 2017, 2018) [1].

**V. Meat production**

In 2020, 8,403.4 t of ruminant meat was produced in Bulgaria. That includes: beef – 6,236.8 t, buffalo meat – 113.4 t, sheep meat – 2014.8 t and goat meat – 38.4 t. Compared to 2001, when 153,590 t of meat were produced, which is negative difference of -145,186.6 t. That includes: beef 21,451 t, or negative difference of -15,213.2 t; buffalo meat 11 t, or positive difference of +102.4 t; mutton 69,614 t, or negative difference of -62,819 t and goat meat with 32,246 t, or negative difference of -7,028 t. The obtained data can be explained by the tendency of decreasing the number of animals, and hence also the quantities of meat produced (Agrostatistics - Survey Number of livestock in Bulgaria, 2021) [2].

**VI. Improved management practices and technologies**

Raising ruminants in mountain regions is challenging because of the rugged terrain and harsh environmental conditions. Such areas can provide opportunities for increasing the amount of production as the animals are grazing on natural pastures and are in a natural environment. The specific challenges and opportunities for producing ruminant products in the foot-hilly and mountain regions of Bulgaria depend on a number of factors, such as the availability of financial and feed resources, local market demand, and specific constraints and opportunities of the region (Angelov et al., 2007) [4].

The dominant ruminant production systems in the foot-hilly and mountain regions of Bulgaria are extensive and semi-intensive. The extensive systems involve the use of large grazing areas, with minimal use of fodder and other inputs. Semi-intensive systems involve the use of smaller pasture areas with additional inputs, such as fodder, housing and veterinary care. Both systems face significant challenges, including limited access to markets and poor infrastructure that make difficult selling livestock products and access raw materials. Moreover, these systems are dependent on harsh climatic conditions, such as extreme temperatures and limited water availability (FAO, 2015) [5].

It is necessary to address some of these challenges in order to improve the sustainability and efficiency of ruminant

products in these regions. For example, investments in infrastructure and transport lead to improved market access and increased profitability of production. Improving access to inputs such as fodder and veterinary care increases the productivity and health status of animals (Nikolova, 2022) [10].

There are opportunities to increase ruminant products in the foot-hilly and mountain regions of Bulgaria by adopting improved management practices and technologies. These opportunities include: breeding and genetics, nutrition and fodder management, health management, upgrading feeding systems and improving infrastructure (Figure 1).

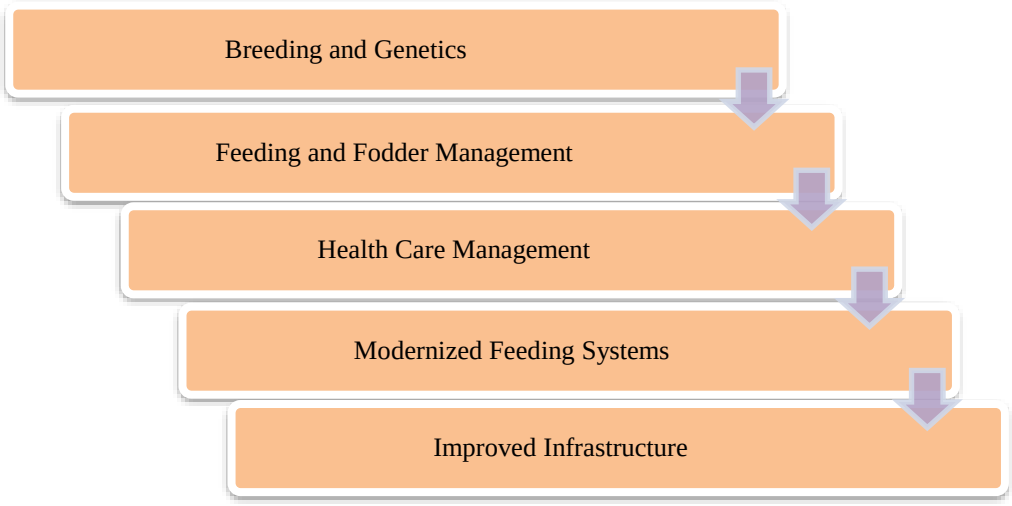


Fig. 1. Improved management practices and technologies
Source: Information summarized by author

**Breeding and Genetics**

The introduction of modern breeds for breeding, through artificial insemination and embryo transfer, improves the genetic potential of ruminant herds. This results in higher productivity, both in terms of meat and milk, and is associated with increased resistance to disease and other stressing factors (Ružićet al., 2002) [12]. Improving the genetics of ruminant herds through artificial insemination and embryo transfer has a number of advantages. Artificial insemination is a method of reproduction in which sperm from a selected male sire is artificially introduced into the female reproductive tract. This can be more efficient and cost-effective way of introducing new genetics into the herd, as it allows producers to use high-quality breeding material from wider range of animals. Embryo transfer from one female to another allows breeders to use the genetics of a high-quality female, even in case of impossibility to produce offspring itself (Hossainet et al., 2021) [7]. The application of these technologies is complex and requires specialized training and equipment, but they are an effective way to improve the genetic potential of ruminant herds and increase their productivity. It is important carefully to consider the specific goals and limitations of the herd when deciding whether and how to use these technologies, and to work in cooperation with specialists, such as livestock engineers and veterinarians to ensure their safe and effective application (Gergovska & Panayotova, 2016) [6].

**Feeding and Fodder Management**

Optimizing the use of available local roughage resources by implementing feeding systems that promote nutrient utilization can improve the efficiency of producing ruminants. This results in higher productivity and reduced costs. Improving feeding and fodder management is an important factor in optimizing the efficiency and sustainability of producing ruminants. By careful selection and management of locally available fodder resources, farmers optimize nutrient

utilization by their animals and improve their productivity.

There are a number of strategies that producers can use to improve feeding and fodder management, including identifying the specific nutritional needs of animals based on factors such as their age, stage of production and activity level, and Selecting fodders that are suitable for the local climate and environment and that provide the necessary nutrients in an efficient and cost-effective manner.

It is important to determine the specific nutritional needs of animals based on factors such as their age, production stage and activity level. This helps to ensure that animals receive the right balance of nutrients to support their growth and development as well as their overall health and well-being. For example, young animals have different nutritional needs in comparison with adults because they are still growing and developing. They require higher levels of protein, energy and certain minerals and vitamins to support their growth. Likewise, ruminants at different stages of development, such as pregnant or lactating animals, have different nutritional needs (Okumuşoğluet al., 2010) [11].

It is important to select fodders that are suitable for the local climate and environment and that provide the necessary nutrients in an efficient and cost-effective manner. Various fodders may have different nutritional profiles, and it is necessary to select those which meet the specific nutritional needs of ruminants based on factors such as their age, stage of production and activity level (Mohiuddinet al., 2019) [9].

The following factors impact the choice of fodders:

-Nutrient content: chosen fodder provides the necessary nutrients in the appropriate balance for the specific needs of the animals;

-Feeding habits: used fodders are palatable to animals, as they are more likely to consume them;

-Costs: fodder costs incurred and the overall economics of animal nutrition should be considered;

-Availability: lots are selected that are readily available and can be easily stored and transported;

-Environmental impact: the impact of the fodder effects on the environment, and any potential impact on the local ecosystem is considered.

**Modernized Feeding Systems**

Feed management systems allow ruminants to self-regulate their intake and can also be used to optimize nutrient utilization. These systems typically involve the access of animals to a range of fodders and allow them to choose the types and amounts they consume based on their individual nutritional needs. They can be particularly useful in situations that animals have different nutritional requirements or available fodders have different nutritional profiles (Nikolova, 2022) [10]. Implementation of feeding systems that optimize nutrient utilization can be an important part of increasing ruminant production. There are several approaches for optimization of nutrient uptake, including balanced rations and feeding management systems that allow animals to regulate their intake by themselves (Selvaggietet al., 2019) [13]. Balanced rations meet the specific nutritional needs of animals based on factors such as their age, stage of development and activity level. They are designed to provide the necessary nutrients in the right balance and proportions, and can feed both as complete fodder and in combination with other fodders. Balanced rations can be achieved by a variety of fodders, including grains, fodder, protein supplements and minerals and vitamins. Careful management of fodder resources minimizes waste and ensures that animals have access to fresh, high-quality fodders. Fodder resource management is a significant part of optimizing the breeding of ruminants. This includes minimizing waste and ensuring that animals have access to fresh, high-quality forage.

**Health Care Management – Health Care**

The implementation of vaccination, deworming and parasite control programs reduces the incidence of disease and parasitosis in ruminant herds and results in improved productivity and reduced costs.

Improved health management can be an important part of increasing ruminant production (Sharma et al., 2019) [14]. Vaccination is a tool to prevent disease in ruminants. Vaccines could stimulate the immune system of animals to produce antibodies against specific diseases, which can help protect them from infection. It is decisive to follow a vaccination schedule that is appropriate for the specific animal needs and the diseases that occur in the area (Markov, 2014) [8].

Deworming is another key aspect of ruminant health management. Parasites can cause a variety of health problems, including weight loss, reduced appetite and reduced productivity. By applying dewormers, it is possible to control and eliminate larvae, which can help improve animals' health and productivity. Skin parasite control is also a distinctive part of ruminant health management. Ticks and lice cause a variety of health problems, including skin irritation, anemia and reduced productivity (Tyankov et al., 2002) [15]. By implementing control measures, such as insecticides or using resistant breeds, it is possible to reduce the spread of parasites and improve animal health. Improved health management is a considerable part of increasing the breeding of ruminants (Gergovska & Panayotova, 2016) [6].

**Improved Infrastructure**

Infrastructure investments such as the construction of roads, barns, warehouses, fodder kitchens and other facilities that support the movement and marketing of animal products improve the accessibility and competitiveness of ruminant breeding in foot-hilly and mountain regions. Improved infrastructure is a major part of increasing the ruminant breeding in the foot-hilly and mountain regions of Bulgaria. Road construction can improve the accessibility of these regions and facilitate the transport of cattle, buffaloes, sheep and goats and animal products to markets, and increase the competitiveness of their production by reducing transport costs and facilitating the delivery of products to market.

Building barns, storage facilities and other infrastructure can improve the quality and value of animal products. The construction of cold storage facilities can preserve the quality of perishable products such as milk and meat, and the construction of processing and packaging facilities for animal products such as butter and cheese will help add value to the products and increase their competitiveness in the market.

In general, infrastructure investments can play a significant role in increasing the breeding of ruminants in the foot-hilly and mountain regions of Bulgaria. It is possible to create a sustainable and profitable industry that can provide a source of income and improve food safety for local communities by improving the accessibility and competitiveness of these regions (Nikolova, 2022) [10].

## CONCLUSIONS

Ruminant livestock constitutes a major share of the total agricultural production of the foot-hilly and mountain regions and must be based on its own resources for feeding. Cattle, buffaloes, sheep and goats in these regions are grazing natural or sown pastures. This process is related to the improvement of the grass stand and its proper use, through rotational grazing.

The potential of the foot-hilly and mountain regions must be oriented towards obtaining products of ruminants which are of high quality and specified geographical region.

Practical application of the proposed management practices and technologies is possible with the support of states, regulatory instruments such as subsidies, premiums, programs, strategies, etc.

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# EVALUATION OF LAND CONSOLIDATION WORKS IN TERMS OF LEGAL RESULTS: THE CASE OF ADANA PROVINCE, TURKIYE

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***Abstract***

*Land consolidation is the rearrangement of small, fragmented, and scattered land owned by agricultural enterprises. The data of the research was collected from the lawsuit files related to the land consolidation works carried out in Yüreğir district of Adana province on 23/11/2012, records of the 6th Regional Directorate of State Hydraulic Works (DSI) which carried out the consolidation and academic studies related to the subject. It is aimed to use less time, labour, and capital, increase agricultural production and productivity, and raise living standards. However, it is important to ensure satisfaction of farmers to provide these benefits. This study evaluated the problems caused by land consolidation from a legal point of view. This research found that the number of parcels of enterprises decreased, the size of the parcels increased, and the parcels received road, water, and drainage services. However, a significant number of producers were not satisfied with the land consolidation and filed lawsuits in the administrative courts. This study revealed that attentive consolidation and careful use of authority can increase satisfaction and prevent unnecessary busying of the courts, saving time and expense.*

***Key words*****:** *land consolidation, politics, Turkey*

## INTRODUCTION

As the world's population continues to increase, the demand for food also increases in parallel. However, since it is not possible to increase the agricultural land that provides food, it is important to use this limited resource effectively. Therefore, it is necessary to increase productivity in agricultural production on limited agricultural land to meet the demand for food.

Agricultural activities are the most basic economic activity required for human survival. One of the world's main problems is the inability to expand agricultural land despite rapid population growth. This problem is more serious in developing countries like our own. The source of the problem lies in the fact that the constant increase in population is not matched by a corresponding increase in land availability, and in fact, land availability is decreasing. Since it is not possible to increase the amount of land that can be used for agriculture in parallel with population growth, ways and methods that will enable more productivity to be obtained from existing agricultural land, which can be considered limited, must be found [13] It is of great importance to manage the agricultural land in a way that will provide the highest yield in order to meet the needs of the increasing population [12].

The constant fragmentation and uneven distribution of land disrupt income distribution and cause waste of resources in agricultural production, negatively affecting the national economy [19]. Land consolidation studies are carried out in agricultural areas to improve and develop production and working conditions, ensure productivity and continuity in agricultural production. The best measure that can be taken to improve the agricultural structure and prevent land fragmentation is land consolidation [16]. The primary goal of consolidation studies is to develop agriculture, increase the quantity and quality of agricultural products, economize the labour

force in agriculture, and ultimately increase the net income of agricultural enterprises [3].

Land consolidation is not only the consolidation of scattered lands but can be defined as making all necessary improvements in all branches of agriculture to achieve maximum yield per unit area and increase labor productivity, and taking all technical, social, and cultural measures that will raise the standard of living of farmers [1]. From a broad perspective, land consolidation involves not only the geometric arrangement of fragmented and irregularly shaped lands but also the creation of a road network in agricultural land to facilitate irrigation, drainage, land levelling, soil conservation, and rehabilitation for increasing the yield per unit area, determining village renewal areas, and preparing village development plans to improve the living environment of farmers, and improving rural landscapes and environments [15].

Land consolidation is carried out to rearrange the small, fragmented, and scattered lands owned by agricultural enterprises according to modern agricultural management, to provide less time, labor, and capital usage, to increase agricultural production and the efficiency of agricultural enterprises by utilizing production factors in the best way, and to raise the living standards of the rural population. From the perspective of farmers, land consolidation has several positive outcomes, including the resolution of property problems, obtaining independent or fewer shares of parcels, parcel enlargement, easier implementation of agricultural techniques and irrigation methods, reduction in the number of parcels, increase in parcel size, access to roads and canals, decrease in distance between the enterprise center and the parcels, and an increase in irrigation rates and yields, and the provision of social peace. However, it is of great importance to ensure the satisfaction of farmers to achieve these expected benefits from the consolidation. In our country, the satisfaction level of farmers is decreasing due to some erroneous and careless practices in land consolidation, which hinders the expected benefits from consolidation.

The success of land consolidation projects increases when the desires of farmers are fulfilled, and sustainable farm size is maintained. Land consolidation projects can reduce migration from rural to urban areas. Therefore, land consolidation projects should be revised in line with the opinions of farmers [4].

In our country, land consolidation practices have a series of positive outcomes such as decreasing the number of parcels and increasing the average farm size and parcel size, providing parcels with road, water, and drainage services, and increasing agricultural production and yield. However, a significant proportion of producers are dissatisfied with the land consolidation practices carried out, and therefore, they file lawsuits in administrative courts. The majority of these lawsuits are based on claims that parcels were not allocated from the desired location or actual usage area, independent or less-share allocations were not made, property problems were created, fragmented and scattered allocations were made, equivalent allocations were not made, problems were encountered with neighboring parcels, and allocations were made from areas without access to roads or water. A significant portion of these lawsuits are resolved in favour of the producer. With careful attention and proper use of authority in consolidation, these negative situations can be eliminated, the satisfaction of farmers with consolidation can be increased, and unnecessary court battles and use of court resources can be avoided, resulting in time and cost savings.

The purpose of this study is to identify the problems that arise in land consolidation practices, evaluate these problems from a legal perspective, and propose solutions for more effective and efficient provision of expected benefits from consolidation.

**Purpose and scope of land consolidation in Türkiye**

The fragmentation, dispersion, and irregularity of agricultural land hinder agricultural activities, reduce production, and cause land degradation. This situation not only leads to resource waste but also requires serious economic investments to correct the

problems it creates. In this context, countries need to take some measures to protect their existing agricultural areas and ensure their effective and sustainable use to improve the living standards of the rural population [9]. Land consolidation studies, which are among the rural area regulation activities, come first among these measures [16].

Land consolidation aims to combine small and fragmented plots of land, achieve a good yield per unit area, improve the quality of agricultural products, increase labor productivity, raise net income of agricultural enterprises, and provide all technical, social, and cultural opportunities that will raise the farmer's living standards and welfare [1]. Land consolidation is an important tool for improving agricultural production efficiency and supporting rural development [17].

In the project area where land consolidation is carried out, the number of parcels decreases, the net land use area and parcel size of the enterprises increase, and parcel shapes are organized. With the implementation of the consolidation project, the number of parcels decreases by approximately 40%, and an average of 80% increase in parcel sizes is achieved [18]. Land consolidation practices result in larger parcels and more regular geometric shapes of parcels. Thus, all parcels benefit from irrigation, road, and drainage networks, and production reaches the highest level.

Through land consolidation, agricultural productivity is increasing, and crop diversity is being achieved. All farmers will benefit equally from physical facilities such as roads, irrigation, and drainage channels. If there is a problem with land ownership in the area, these issues are resolved, and the existing cadastre is updated. As all plots directly benefit from roads and irrigation channels, problems with roads and water between farmers are prevented. This will positively impact social harmony in rural areas by preventing serious disruptions that have occurred in irrigated areas. Land consolidation should not be seen solely as an application for agricultural activities. Consolidation projects are also of great importance in solving the socio-economic problems of rural areas, as well as for agricultural activities. Land consolidation is also intended to improve the working conditions of the rural population and create a multi-dimensional rural area that will slow down migration from villages to cities. The consolidation process also makes a significant contribution to the protection of historical and cultural areas. The possibility of creating job opportunities that will keep young people in the village is being created. Land consolidation also prevents the occupation of pasture lands, private lands, and state lands.

According to the Agriculture Reform Law on Land Regulation in Irrigation Areas No. 3083, consolidation aims to cultivate land in a productive manner, protect and maximize economic yields, ensure sustainable agricultural production, and increase employment opportunities. State-owned lands are used to establish agricultural family businesses for those who do not have enough land or who are landless. The law also aims to prevent fragmentation and shrinking of agricultural land that is not sufficient for a family's livelihood and utilization of labor force. The Agriculture Reform Law on Land Regulation in Irrigation Areas No. 3083 Implementation Regulation, which is based on this law, emphasizes the same issues, and sets out the principles and procedures for consolidation, as well as how land classification should be carried out.

Land consolidation works include the following:

Combination of excessively fragmented and dispersed lands according to modern management principles,

Construction of field road network, irrigation facilities and surface drainage system,

Necessary land levelling and soil reclamation,

Reorganization of village locations and environmental planning,

Protection of rural areas, preservation of natural life, and regulation of green areas,

Taking necessary measures to protect settlements and land in rural areas from natural disasters such as wind and water erosion, flood,

Rehabilitation and reorganization of agricultural enterprises and taking necessary measures to ensure their efficient operation,
Organization of village roads, planning of services such as drinking water, sewage, electricity, and telephone, and covering operations such as settlement and land requests.

**Benefits of land consolidation works**

Land consolidation provides many direct and indirect physical, economic, and social benefits in rural settlements. The main benefits identified from these are listed below in terms of items.

1- Elimination or reduction of partition status in parcels,
3- Prevention of fragmentation and division in agricultural land (due to the inability to partition below the areas specified by laws),
4- Construction of field development services such as road, irrigation canal, drainage, infrastructure works, and environmental planning,
5- Avoiding economic burden in projects carried out for the public interest without expropriation,
6- Identification of pasture areas, their consolidation, and creation of access roads to pastures to protect and develop animal husbandry,
7- Implementation of stream rehabilitation works,
8- Arrangement of stone collection and levelling in agricultural areas,
9- Cadastral renewal,
10-Providing the opportunity for boundary correction in fixed facilities built on erroneous boundaries over time,
11-Providing economic savings and preventing social problems by ensuring that each parcel has access to roads and keeping road networks short,
12-Increasing production and yield,
13-Saving time and labour by directing towards mechanization,
14-Facilitating irrigation by constructing irrigation canals,
15-Separation of settlement areas and agricultural areas,
16-Preventing occupation of pastureland,
17-Distributing treasury lands fairly to increase the population engaged in agriculture and prevent landowners from dominating,
18-Updating property information,
19-Contributing to valuation with rating maps,
20-Increasing regional prosperity,
21-Delimitation of village boundaries,
22-Being more economical compared to another cadastre works in general overview,
23-Displaying boundaries in the field without being subject to payment by handing over the place,
24-Inclusion of areas outside registration in the cadastre,
25-Preventing snowmelt from causing flooding in the spring and determining the direction of water flow by designing drainage channels, preventing it from flowing,
26- Reorganization in military zones to prevent security vulnerabilities.
27- Proper evaluation of decreasing water resources.
28- Correction of discrepancies in land registry and cadastral maps, such as areas that do not match or exceed the boundary limits.
29- The awareness of heirs who have been separated from their lands for various reasons in villages for many years, and their participation in land consolidation projects [10, 6, 15, 11].

**Reasons for land consolidation in Türkiye**

One of the most important problems in the agricultural sector in Turkey is that enterprises have a fragmented and scattered ownership structure [14]. Agricultural land in our country has shrunk and been fragmented for various reasons, with productivity and profitability far below what they should be. The decrease in farm size makes it impossible to practice economically viable agriculture [18, 3]. In addition, due to inheritance, agricultural enterprises are divided, increasing in number, and moving away from economic scale [7]. Agricultural enterprises in our country are fragmented and not large enough. The amount of land on which producer-based enterprises carry out their production activities is limited and scattered across numerous small parcels, making it difficult to

construct stable businesses and achieve the expected production performance [5].

In Turkey, problems such as land scarcity and uneven distribution of land ownership, small, fragmented, scattered, and irregular parcels increase investment costs, labor, and time requirements in the production system [21]. One of the most important tools for improving the shrinkage, fragmentation, and irregularity of agricultural land has been land consolidation [18, 3].

Studies have shown that a farmer in Turkey has about six different parcels of land with varying sizes and characteristics. Those who own only one parcel have the lowest rate at 9.46%, while those with 2-9 parcels have a rate of 70.84%, and those with more than 10 parcels have rates of 19.70%. Farmers engaged in agriculture are divided into approximately 4,000,000 parcels. Due to the high costs associated with managing fragmented land, high yields cannot be achieved. This is because healthy farming cannot be carried out on different parcels with different locations, sizes, qualities, and shapes. As a result, the desired yield cannot be achieved [14, 8].

Among the basic problems of agriculture, "agricultural structural disorder," also known as "agricultural entity disorder," comes first. This problem makes it difficult to take measures to increase productivity, so "structural regulation in agriculture," also known as "agricultural entity improvement," gains importance. In addition to the inadequacy of agricultural enterprises' land in our country, the fact that existing lands are scattered into small pieces without an effective transportation and irrigation network leads to a bigger problem [6].

In response to this situation, in our country, land consolidation practices aim to reduce parcel numbers and increase parcel areas, eliminate ownership problems, and bring them into square and rectangular shapes that facilitate the application of modern agricultural techniques while minimizing the loss of land. With consolidation, parcels will not only grow but also have improved shapes, ensuring that all parcels are connected to the irrigation network, and increasing the irrigation rate [20]. Land consolidation will also facilitate the construction of irrigation, drainage, and transportation networks. Parcel shapes, parcel access, and the topographic structure of the parcels will improve after consolidation, increasing the irrigation rate and irrigation efficiency accordingly. In the irrigation projects carried out together with land consolidation studies, land losses, common facility participation fees, and irrigation and transportation lines passing through parcels will be distributed equally to all parcels in the field, eliminating the need for expropriation. Access to all parcels will be provided [12].

It is planned to consolidate approximately 14 million hectares of agricultural land in Turkey that can be implemented under the Land Consolidation project until 2023. Of this area, 8.5 million hectares are irrigated areas, and 5.5 million hectares are dry farming areas. As of 2009, a total of 1,115,000 hectares of agricultural land were completed under the Land Consolidation projects by the Mülga Topraksu, Mülga Village Services General Directorate, and Agricultural Reform General Directorate. Between 2010 and 2014, 5,700,000 hectares of agricultural land were consolidated by the Agricultural Reform General Directorate [13]

## MATERIALS AND METHODS

The data of the research was collected from the lawsuit files related to the land consolidation works carried out in Yüreğir district of Adana province on 23/11/2012, records of the 6th Regional Directorate of State Hydraulic Works (DSI) which carried out the consolidation and academic studies related to the subject. First, the literature on land consolidation was created, then records of the land consolidation works carried out on 23/11/2012 in Yüreğir district of Adana province were examined comparatively in terms of the status of the immovables before and after the consolidation, the size of the operation, the number of parcels, the ownership status, and so on, based on the records of the 6th Regional Directorate of DSI. Then, the scope and content of the

problems encountered in the land consolidation application were revealed through the court decisions given in the lawsuits opened by determining how many of them were subject to litigation, and evaluations and recommendations based on this data were made.

## RESULTS AND DISCUSSIONS

The data obtained from the 6th Regional Directorate of State Hydraulic Works in Adana province, Yüreğir district on 23/11/2012 regarding the land consolidation is as follows:

The Yüreğir Plain, covering an area of 28,257 hectares and 21 neighborhoods in Adana province's Yüreğir district, was included in the Yüreğir Ovası 1st Phase Land Consolidation and Irrigation Project on 23/11/2012, and the project was completed on 10/03/2021. (Figure 1, Table 1)

**Adana Yuregir Plain**

**1st Part Land Consolidation and On-farm Development Services Project**

Project implementation status

Adana Yuregir Plain 1st Part Land Consolidation (LC) and On-Farm Development (OFD) services project work covers 28.257 ha area and consists of 21 neighborhoods of Adana Province Yuregir County. Registration procedures for all of the 21 neighborhoods in the project area have been completed.

Provisional Acceptance Date

Project Location

Adana Province, Yuregir County

Project Goal

28.405 ha Land Consolidation and On-farm Development Services

Contract Information

Contractor's name

Tender Date

Contract Date

Tender Price

Work done with contract prices.

Start date.

Work end date after time extension

financial realization

Physical realization

Fig. 1. Map and Information on Villages Subject to Consolidation in Yüreğir District, Adana Province
Source: Records of the 6th Regional Directorate of State Hydraulic Works [20].

In Yüreğir district, a total of 28,405 hectares of land was consolidated by including 21 villages with a total area of 36,090 hectares in the project area.

As a result of consolidation, the number of blocks was organized as 1,707, with a block area of 27,134 hectares. It was observed that the number of parcels decreased from 9,549 before consolidation to 7,125 after consolidation (Table 1).

Thus, the number of parcels decreased by 25.4%, while the average parcel width before consolidation was 2.97 hectares, and after consolidation, it increased by 34.0% to 3.99 hectares.

These figures vary by village. For example, in Araplar Village, the average parcel width increased by 105.2% from 3.46 hectares to 7.10 hectares after consolidation (Table 2).

Table 1. Area and Parcel Information by Villages in the 1st Phase Consolidation in Yüreğir District, Adana Province

| Province | County | District | Settlement area | Project area | Total Block area | Block Number | Parcel Numer | Before | After |
|---|---|---|---|---|---|---|---|---|---|
| Adana | YÜREĞİR | ABDİOĞLU | 3.590 | 3521.62 | 3.403 | 152 | 838 | 562 | 1,9 |
| Adana | YÜREĞİR | AĞZIBÜYÜK | 772 | 766.38 | 737 | 37 | 276 | 188 | 2,8 |
| Adana | YÜREĞİR | ALİHOCALI | 1.030 | 967.45 | 930 | 79 | 640 | 379 | 1,7 |
| Adana | YÜREĞİR | ARAPLAR | 1.096 | 1094.92 | 1.051 | 62 | 318 | 154 | 2,3 |
| Adana | YÜREĞİR | CAMİLİ | 2.305 | 2142.48 | 2.090 | 111 | 918 | 458 | 0,6 |
| Adana | YÜREĞİR | ÇOTLU | 1.747 | 1.690.14 | 1.608 | 116 | 535 | 586 | 4,1 |
| Adana | YÜREĞİR | DAĞCI | 551 | 459.84 | 438 | 24 | 325 | 193 | 2,8 |
| Adana | YÜREĞİR | DEDEPINARI | 2.123 | 2107.01 | 2.025 | 66 | 419 | 272 | 2,4 |
| Adana | YÜREĞİR | GEMİSURA | 1.267 | 1178.23 | 1.136 | 63 | 338 | 236 | 1,7 |
| Adana | YÜREĞİR | GÖKVELİOĞLU | 608 | 536.79 | 503 | 47 | 182 | 201 | 3,1 |
| Adana | YÜREĞİR | HAVRANİYE | 4.521 | 3449.80 | 3.295 | 172 | 858 | 797 | 0,7 |
| Adana | YÜREĞİR | HEREKLİ | 547 | 521.83 | 497 | 49 | 209 | 163 | 2,8 |
| Adana | YÜREĞİR | İNNAPLI | 1.538 | 802.66 | 1.414 | 74 | 617 | 327 | 2,2 |
| Adana | YÜREĞİR | İNCİRLİK | 1.410 | 1464.45 | 747 | 56 | 221 | 188 | 1,3 |
| Adana | YÜREĞİR | İSMAİLİYE | 1.470 | 1115.03 | 1.072 | 89 | 492 | 296 | 2,8 |
| Adana | YÜREĞİR | KAPULU | 2.120 | 2050.47 | 1.935 | 100 | 347 | 343 | 2,7 |
| Adana | YÜREĞİR | MİSİS | 3.327 | 935.67 | 895 | 58 | 327 | 304 | 2,2 |
| Adana | YÜREĞİR | NACARLI | 990 | 647.05 | 608 | 34 | 248 | 229 | 2,6 |
| Adana | YÜREĞİR | SULUCA | 2.638 | 1027.13 | 973 | 43 | 256 | 237 | 2,0 |
| Adana | YÜREĞİR | YÜREKLİ | 1.059 | 1005.13 | 950 | 63 | 660 | 402 | 2,9 |
| Adana | YÜREĞİR | ZİYANLI | 1.381 | 921.86 | 827 | 109 | 525 | 610 | 2,3 |
| Adana | YÜREĞİR | KÜTÜKLÜ | | | | 38 | ORMAN KADASTROSU YAPILAMADIĞI | | |
| Adana | CEYHAN | KIZILDERE | | | | 65 | ORMAN KADASTROSU YAPILAMADIĞI | | |
| TOPLAM | | | 36.090 | 28.405 | 27.134 | 1.707 | 9.549 | 7.125 | |

Source: Records of the 6th Regional Directorate of State Hydraulic Works [20].

Table 2. Change in Parcel Width in Araplar (Sağdıçlı Village) after Consolidation

| | | |
|---|---|---|
| Average parcel area | Before (Hectare) | 3.46 |
| | After (Hectare) | 7.1 |
| | Increase (Percent) | 105.2 |

Source: Records of the 6th Regional Directorate of State Hydraulic Works [20].

Through consolidation, a total of 482,959 km of road construction and 385 road crossings were made, with 226,673 km being 4 meters wide and 256,286 km being 6 meters wide, and 6,716,191.12 $m^3$ of levelling work was completed. There are a total of 2,169 farmers in the Yüreğir district. Before consolidation, the average number of parcels per farm was 4.4, but after consolidation, it decreased by 25.4% to 3.28 parcels per farm. The decrease in the number of parcels per farm will contribute to a decrease in farm costs [13].

**Objections and lawsuits against land consolidation in Yüreğir District**

Regarding objections and lawsuits filed against land consolidation in the Yüreğir district, many benefits, such as reducing the number of parcels and increasing the average parcel size, resolving ownership issues, and providing access to transportation, roads, and drainage services, were found in both our research and other academic studies [2]. Research has been conducted on the satisfaction levels of producers with consolidation and the factors that affect their satisfaction. In a country where land is considered sacred, even a single change to a person's property rights through consolidation is of great importance, and careless and improper practices in this regard can create many legal problems. However, studies in Turkey have not taken this aspect of the issue into account. After land consolidation, some farmers in villages objected to the consolidation, and these objections were not taken into sufficient consideration, resulting in serious problems that are difficult to remedy and reducing the expected benefits of consolidation. Incorrect, incomplete, and careless practices make it difficult for farmers to accept consolidation and lead to a decrease in their satisfaction levels. These problems are raised among farmers, but due to reasons such as their education and consciousness, financial constraints, and feeling powerless against public authority, they have difficulty expressing their dissatisfaction and seeking legal action. Despite this situation, a significant number of objections were raised, and lawsuits were filed due to the failure to address these objections.

**According to our research, the objections raised by farmers were examined under**

**main headings and information was provided about the lawsuits filed:**

***(1)Objections to land consolidation in Yuregir District***

The objections raised by farmers regarding the land consolidation carried out on November 23, 2012, in Yüreğir district of Adana province, obtained from the 6th Regional Directorate of the State Hydraulic Works (DSİ), are summarized below:

(a) The objections raised by farmers about land allocation and distribution (parcelling) are among the primary objections. Some of the main objections regarding parcelling include failure to provide equivalent land allocation, allocation of completely independent or less joint/shared land, failure to take into account fixed facilities in allocation, failure to allocate land from its original location, failure to consider actual usage status in allocation, allocation of land in remote locations, insufficient land allocation, allocation of steep, unsuitable for cultivation, dry stream beds, rocky areas, etc.

(b)Objections related to the shape and structure of the parcel, such as the parcel shape not being suitable for agricultural production, the parcel not being in a rectangular shape, and the length-to-width ratio not being appropriate.

(c)Some landowners have requested that their properties not be included or be excluded from the consolidation scope.

(d)Objections to land grading; that the land classification was incorrectly determined that soil analysis was not done thoroughly or carefully enough during grading, that the sample taken did not represent the entire land, that the soil index score was incorrectly determined due to insufficient sample numbers and depths.

(e)Objections related to public lands, such as the request for the continuation of the rights of the owners who obtained the right to purchase the properties belonging to the Treasury due to actual usage, the request for exchange with pasture lands, and the request for the purchase of Treasury properties on which investment has been made.

(f)Objections related to common areas of public use, such as objections to not cutting the common use share or cutting it less.

(g)Objections related to neighbouring properties, such as the desire to be neighbours with relatives or desired persons or the objection to being neighbours with certain people.

***(2) Lawsuits Filed Regarding Land Consolidation in Yüreğir District***

It was observed that while some of the objections raised by farmers regarding the land consolidation carried out on November 23, 2012, were considered by the administration and some corrections and changes were made, a significant portion of these objections were subject to lawsuits filed by farmers. It was also observed that significant numbers of farmers were given favourable decisions in these lawsuits. Out of the 15 cases examined in our study, 60% (9 cases) were concluded in favor of the farmers. These decisions are summarized along with their justifications and results below:

(a)In the case filed by the plaintiff regarding the cancellation of the land consolidation process carried out in the area where the immovable property numbered... is located in the district of Yüreğir in the Adana province, it is stated that although the Public Joint Use Share (PJUS) ratio was calculated as 0.016862000 in the consolidation process subject to the lawsuit, it was seen that this ratio remained below the 10% limit prescribed by the law, and while it was possible to preserve the boundaries of the subject property in its old location, there was no technical, legal, or factual necessity to change its boundaries, and in addition, with regard to the fixed facilities located in the subject property; it was stated that the construction permit dated 24/02/2012 was available, the occupancy permit was issued on 20/08/2014, and according to the land registry records dated 17/12/2014, the nature of the property was specified as a 3-storey concrete chicken house and field, and it was seen that, within this scope, it was necessary to give the owners of the enterprise structures and facilities and permanent fixtures such as vineyards and gardens in the consolidation area, to the extent

possible, but it was observed that the fixed facility in the subject property was allocated from a different area to the plaintiff during the distribution process, and thus, it was understood that the consolidation process carried out on the parcel in question was established in violation of the purpose and principles of Law No. 3083 by taking into account such issues as land structure, soil characteristics, parcel properties, current land use status, grading map, old ownership map, and therefore, there is no legality in the consolidation process subject to the lawsuit on the parcel in question, as stated in the decision dated 04/11/2021 and numbered E:2020/1077 K:2021/1556 of the Adana 2nd Administrative Court, which was confirmed by the decision dated 18/03/2022 and numbered E: 2021/2330, K: 2022/1025 of the Adana Regional Administrative Court 1st Administrative Trial Department.

(b) In the case filed by the plaintiff for the cancellation of the land consolidation process carried out in the area where the immovable property numbered... is located in the district of Yüreğir in the Adana province, which is jointly owned by the plaintiff, it was stated that it was found out that the plaintiff's fixed facility (garden) was not taken into account during the consolidation process, which was carried out in a way that would be contrary to the legislation provisions and land consolidation principles, and it was understood that the soil score was calculated incorrectly by giving a score of 0 (zero) in violation of the technical instruction, and therefore, it was concluded that there was no legality in the consolidation process for the parcels in question, as stated in the decision dated 21/09/2021 and numbered E:2020/1564, K:2021/914 of the Adana 1st Administrative Court, which was confirmed by the decision dated 03/03/2022 and numbered E: 2021/2203, K: 2022/814 of the Adana Regional Administrative Court 1st Administrative Trial Department.

(c) The case concerns a lawsuit filed by the plaintiff who is a co-owner of a property located in the Yüreğir district of Adana province, in the … neighborhood, on the parcel number … (new … parcel) against the land consolidation process carried out on the said property. According to the information and documents in the case file, along with the expert report, it was determined that the KYPKO value of the property, which is owned by the plaintiff as a co-owner, was 0.007503 in the consolidation process carried out on the property, and it was concluded that the legal limit of 10% was not exceeded and thus, the determination of the KYPKO value was in accordance with the legislation. It was also found that there was no garden on the land in question in 2015, 2016, and 2017, and new garden constructions had started in certain areas of the land in 2018. The garden area identified during the survey of the land was confirmed to be made by the plaintiff. The consolidation process on the land in question began on a certain date with a certain decree and was completed with the registration to the land registry on another date. It was also determined that the plaintiff and his/her sibling's fixed asset areas were located on the … cadastre parcels, which were allocated to them by the consolidation process, as well as on the … parcel and … cadastre parcel, and the provisions of the legislation were complied with regarding the allocation of the zoning parcels on these areas to the plaintiff and his/her sibling, while protecting the fixed asset areas. However, it was also concluded that although the plaintiff accepted to have made the garden area on the … parcel after the fixed asset protocol was signed, the registration of the consolidation process was done almost 2 years after the garden construction, and the allocation of the … parcel, where the plaintiff did not have any share, and the allocation of the garden on the … parcel, where other people's structures existed, caused a property problem for the plaintiff. Therefore, the land consolidation process on the property in question was found to be against the legislation and the lawfulness of the process was found to be unfounded. The decision of the Adana 1st Administrative Court dated 29/06/2021 with the file number E:2019/1364, K:2021/717, which ruled the annulment of the consolidation process, was upheld by the Adana Regional Administrative Court 1st Administrative Trial Department

with the decision dated 02/02/2022 and the file number E:2021/1849, K:2022/292.

(d)In the lawsuit filed by the plaintiff, who is the owner of the immovable properties numbered …, …, and (new …, …, and … parcels) in the Yüreğir district of the Adana province, regarding the cancellation of the land consolidation process carried out in the area covering the immovable properties, "it is concluded that there has been a violation of relevant legislation and the principles and objectives of the consolidation process in terms of creating parcels with a geometric shape that would limit agricultural activities such as cultivation, planting, irrigation, fertilization, and spraying for the parcel numbered …, which is currently vacant and used as a field, due to its geometric shape, and in terms of not taking into account the citrus orchard with a fixed facility on the parcel numbered …, which is entirely a fixed facility in the consolidation process despite the absence of any technical, legal, or practical necessity, and in terms of assigning a total of 102,471.56 m² of land allocated to the plaintiff after deduction of the Public Joint Use Share (PJUS) and taking into account the parcel conversion coefficients, in a location approximately 3.9 km southeast of parcel … where the plaintiff has no property rights, in the area that may lead to property disputes, in cooperation with the Treasury Department, on the parcel numbered …, block …, resulting in the plaintiff being assigned a share of 1,783.94 m² from the earnings obtained from parcel numbered …, it is understood that there has been a violation of relevant legislation and the principles and objectives of the consolidation process; it is concluded that there is no compliance with the law regarding the immovable properties numbered …, …, and …, and that compliance with the legislation and the objectives and principles of consolidation has been followed regarding the distribution of the share on parcel numbered …, and therefore, the request for the annulment of the process in question regarding the immovable properties numbered …, …, and … is accepted, and the request for the annulment of the process regarding the immovable property numbered … is rejected, according to the decision dated 22/01/2021 and numbered E:2019/830, K:2021/162 of the Adana 2nd Administrative Court, which was upheld by the Adana Regional Administrative Court, 1st Administrative Law Department, in the decision dated 24/12/2021 and numbered E:2021/693, K:2021/2755.

The lawsuit concerns the cancellation of a land consolidation process carried out on immovable properties located in Yüreğir district of Adana province, Turkey. The court concluded that there had been violations of relevant legislation and the principles and objectives of the consolidation process. The court accepted the request for the annulment of the process in question regarding some immovable properties but rejected the request regarding one of the immovable properties. The decision of the Adana 2nd Administrative Court dated 22/01/2021 and numbered E:2019/830, K:2021/162 was upheld by the Adana Regional Administrative Court, 1st Administrative Law Department, in the decision dated 24/12/2021 and numbered E:2021/693, K:2021/2755.

(e) In the lawsuit filed by the plaintiff who was designated as a joint shareholder in parcel number ... as a result of the consolidation of his shares located within the boundaries of ... neighborhood, Yüreğir district, Adana province, requesting the separate delivery of his shares in the said parcel as a single piece, against the rejection of the application by the State Hydraulic Works General Directorate 6th Regional Directorate with the decision numbers ... and ..., it is understood that the consolidation process caused a property issue for the plaintiff and his spouse in the parcel number ... which was formed to have a total area of 94,422.93 m² (real area) by allocating it to 5 people, along with the shares coming from the parcels they owned before the consolidation process, totaling 25,949.98 m², without any technical, legal, or factual necessity. Therefore, the administrative court of Adana decided to annul the aforementioned decision with reference to the relevant legislation and unlawful act in terms of this matter on the property in question in its decision numbered 2019/210 E. and 2020/493 K. dated 04/06/2020. This decision was

upheld by the Adana Regional Administrative Court 1st Administrative Trial Department in its decision numbered 2021/162 E. and 2021/1991 K. dated 26/10/2021.

(f) In the lawsuit filed against the decision of the State Hydraulic Works General Directorate 6th Regional Directorate to reject the plaintiff's application for the correction of the consolidation process and the parcel owned by it, located in the area of parcel number ..., in Adana province, Yüreğir district, ... neighborhood, within the scope of the Adana, Yüreğir Plain 1st Part Irrigation and Land Consolidation Project, by the plaintiff's attorney, it is argued that the consolidation process caused a significant loss of rights for the plaintiff due to the allocation of parcels created outside the area where the citrus garden, a fixed facility of the plaintiff, was located from parcel number ... which had no technical, legal, or factual necessity for the allocation, and the allocation of parcel number ... located in the said citrus garden area to other shareholders of parcel number ... who were his co-owners. Therefore, it is claimed that the consolidation process and the decision rejecting the objection to this process are contrary to the purpose and principles of the consolidation process and unlawful in terms of the distribution of the plaintiff's share in parcel number .... The administrative court of Adana decided to annul the decision with reference to these claims in its decision numbered 2019/125 E. and 2020/150 K. dated 04/02/2020. This decision was upheld by the Adana Regional Administrative Court 1st Administrative Trial Department in its decision numbered 2020/791 E. and 2021/932 K. dated 27/04/2021.

(g) The case was filed by the attorney of the plaintiff, regarding the cancellation of the consolidation process and the implicit rejection of the application made on the date of... regarding the consolidation process registered with the transaction number... with the consolidation process carried out in the area where the immovables with the old parcel numbers in ...Village of Yüreğir District in Adana Province, which is owned by the client. It is stated that the plaintiff, who had a total area of 210,221.27 square meters in parcel number... in ... island, became a co-owner with a person named ... and he had the right of ownership in parcel number... alone before the consolidation process, and in return for his entitlement from parcel number... according to the parcel indexes in the consolidation process, he had the opportunity to allocate the entire 197,441.48 square meters of land allocated to him independently. It is seen that there was no technical, legal or actual necessity in the consolidation process in question, and that a property problem was caused by allocating the plaintiff shares, and it was concluded that the consolidation process in question was contrary to Article 16/1-(b) of the Land Consolidation and Field Development Services Implementation Regulation and the law. On the other hand, it is stated that while the citrus orchard of 3,627.29 square meters on parcel number... belonging to a person named ... was given to the plaintiff as a result of the consolidation process, 1,257.00 square meters of the citrus orchard on parcel number... belonging to the plaintiff were given to ... person. Therefore, it was observed that there was no loss of rights for the plaintiff, as approximately 1,257.00 square meters of the citrus orchard in the area where parcel number... was located was allocated to ... person, and it was concluded that the area where the citrus trees were located on the immovable property with the old parcel number... could not be registered as a separate parcel for another person due to this reason. Therefore, the Adana 1st Administrative Court's decision on the implicit rejection of the application made on the date of... regarding the consolidation process and the cancellation of the consolidation process for the plaintiff parcel was rejected. The decision was upheld by the Adana Regional Administrative Court's 1st Administrative Trial Department on 30.03.2021, with the decision number E: 2020/989, K: 2021/641.

(h)Plaintiff, the owner of parcel number ... in the neighborhood of ... in Yüreğir district of Adana province, filed a lawsuit claiming compensation of 1,000.00 TL for the damage caused by the inclusion of his olive trees in the neighboring parcel due to the

consolidation operation carried out without a date and number and for not being able to benefit from the animal shelter in the 8-9 reinforced concrete structures also included in the neighboring parcel and for some of them to be demolished. In the lawsuit, it was claimed that the consolidation operation should be cancelled. The court evaluated the information and documents in the case file and the expert report that could be used as a basis for the decision to be made by the court together. It was concluded that although there was a possibility of allocating the full amount of plaintiff's entitlement independently from the area where his own parcel was located, as the aim of the consolidation was to increase the efficiency of agricultural production and the life standards of the rural population by utilizing production factors in the best way possible with less time, labor, and capital usage, and there was no technical, legal, or factual necessity in the consolidation process under dispute, this opportunity was not evaluated, and plaintiff's share was allocated from the parcel number ... located about 2200 meters northwest of his own parcel, resulting in him being turned into a joint owner with 18 people and causing ownership problems for plaintiff. Therefore, it was concluded that the consolidation process under dispute was not in compliance with the Regulation on the Protection, Utilization and Consolidation of Agricultural Lands and the law. Furthermore, although it was requested that compensation be paid for the damages caused by the inclusion of olive trees in the neighbouring parcel and the inability to benefit from the animal shelter in the 8-9 reinforced concrete structures, and for some of them to be demolished, when the expert report and the case file were examined together, it was found that the 15 olive trees, which were in their 20s and owned by the owner of the parcel number ... in the cadastre, mentioned by the plaintiff, were actually owned by the owner of the parcel number .... It was also determined that the 2-storey house and outbuildings owned by the plaintiff were built during the consolidation process after April 2, 2015, and that the plaintiff did not make any notification or request to the relevant authority before starting construction or give any commitment. Therefore, it was concluded that there was no situation where the 2-storey house and outbuildings on plaintiff's parcel were not taken into account in the distribution during the consolidation process under dispute. It was concluded that there was no violation of the relevant legislation and the principles and objectives of the consolidation process. Therefore, the request for compensation for damages was rejected, and it was concluded that there was no legal basis to hold the administration responsible for the damage.

(i) In the lawsuit filed by the plaintiff, cancellation of the consolidation process carried out in the area covering parcel number ... in the district of Yüreğir, Adana province, was requested. As a result of the evaluation of the information and documents in the case file together with the expert report, it was concluded that the deduction made in connection with the transaction subject to the lawsuit was below the legal limit. It was also determined that an independent allocation was made to the plaintiff in the place where their citrus orchard was located on the north border of the cadastral parcel they owned, and an 8-meter wide gap was left between the citrus orchard owned by the plaintiff and the citrus orchard owned by ... which belonged to the shareholders of the cadastral parcel on the south side of the plaintiff's citrus orchard, which was intended to serve as a road for the maintenance of the two gardens and the use of agricultural tools, and that this road was within the property allocated to ... Despite the fact that both properties benefited equally from this empty space, it was not added to both properties in equal parts. It was also determined that the consolidation process, which was established without any legal, technical, or practical necessity, was not appropriate for its purpose, and therefore, the consolidation process subject to the lawsuit was cancelled by the decision of the Adana 2nd Administrative Court dated 17/09/2019, numbered E:2018/1014, K:2019/752, and this decision was upheld by the decision of the Adana Regional Administrative Court 1st Administrative Trial Division dated

18/02/2021, numbered E:2020/743, K:2021/360.

## CONCLUSIONS

Land consolidation reduces the number of fragmented, scattered, shapeless, and highly divided agricultural lands and increases the parcel areas, eliminates property issues, and provides parcels with road, water, and drainage services. Thus, agricultural production is carried out more effectively and efficiently, and the amount of agricultural production is increased. However, due to the erroneous and careless practices during the implementation of consolidation, the effectiveness of consolidation decreases, and the expected yield cannot be provided sufficiently. Considering the objections raised on this matter and the inadequate responses to objections, it is seen that erroneous and careless practices during the implementation phase pose a serious problem considering the decisions made in the court cases opened.

In the land consolidation conducted on 23/11/2012 in the Yüreğir district of Adana province, the objections raised and the subsequent lawsuits were mostly based on the failure to provide equivalent allocations, failure to provide on-site allocations, allocation of divisible or highly divisible properties while independent or less divisible options were available, creating property issues, making mistakes in land index values and grading, failure to give or giving less facing to the road, allocating land in areas unsuitable for sustainable agriculture, making allocations that are not consistent with the actual situation, and parcels being unsuitable geometrically. It is seen that a significant part of these claims resulted in favor of the plaintiffs.

As a result of our examinations and analysis in our research, together with the reasons for the decisions made by the Courts in the lawsuits opened on the subject, it is observed that the most common erroneous and incomplete practices of the administration in consolidation are the inadequate consideration, incomplete implementation, and erroneous interpretation of the provisions of the relevant legislation. In addition, factors such as insufficient and inadequate sampling when determining the land value index, insufficient examination of the legal and actual situation of the immovable, insufficient information exchange with relevant institutions, inadequate interviews with farmers, and inadequate handling of objections can be counted as other problems identified where necessary and sufficient data were not obtained before implementation and adequate care was not taken during implementation.

If more careful implementation and more careful exercise of authority are ensured in consolidation, the stated negative situations will be eliminated, the expected goals of consolidation will be achieved more effectively and efficiently, and the satisfaction of the farmer with consolidation will increase, the producer will not have to struggle unnecessarily in court, the unnecessary occupation of the courts will be prevented, and thus time and cost savings will be achieved. The workload of the courts will also be prevented from increasing unnecessarily.

As a result of our research findings and evaluations, the solutions we propose are:

1- One of the most important conditions for the qualified and effective implementation of consolidation is the selection of competent personnel who have sufficient knowledge and experience in their field to carry out the consolidation process.

2- It is considered necessary to make a legal regulation regarding the creation of an independent unit for the inspection of the work and transactions carried out by the personnel conducting consolidation activities, and to subject them to inspection by this unit. This inspection unit will ensure that consolidation activities are carried out more carefully and meticulously in terms of compliance with both legislation and consolidation principles and rules, and that healthy and reliable results are obtained through its inspections.

3- It is thought that a Commission consisting of experts in the field of consolidation, including academicians, lawyers, agricultural engineers, and surveying engineers, should be

established to examine and resolve objections made by farmers after interviews conducted during the consolidation phase through a legal regulation. In this way, a large portion of disputes can be resolved quickly and effectively through administrative means without going to court.

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# ASSESSING THE STATE OF FERTILITY (QUALITY) OF THE SOILS FOR SUSTAINABLE AGRICULTURE IN REMETEA MARE, TIMIS COUNTY, ROMANIA

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***Abstract***

*The values obtained give us a series of information related to the factors present in the soil, factors that affect or limit the fertility and quality of these soils, such as: humus content, reaction, degree of settlement, etc. whose knowledge is particularly important because a series of improvement or limitation measures can be taken in time allowing the practice of sustainable agriculture. In the current context of climate change, both soils and crops are particularly vulnerable to a series of changes and environmental factors. In this context, the sustainable use of soils aims at improving soil quality and obtaining higher and qualitatively significant productions. This can only be achieved by knowing soil physical, physical-mechanical and chemical properties. This paper shows a series of soil properties, such as texture, densities, porosities, pH, humus content, total nitrogen content (%), mobile phosphorus (ppm), mobile potassium (ppm) content and soil settlement degree (%) in the seven types of soil identified within the studied perimeter.*

***Key words*****:** *assessment, soil quality and fertility, sustainable agriculture, soil properties, limiting factors*

## INTRODUCTION

The basis of this study is the hypothesis that "healthy soils provide an optimal environment for soil organisms that stimulate the physiological and biochemical response of plants to stress and climate change" [15, 18]. One of the main agricultural problems worldwide is the decrease in fertility and, implicitly, in soil quality, mainly because of the reduction of soil biodiversity and of the content in organic matter, nutrients and water [7, 16].

Agricultural soils are particularly susceptible to this problem, as they rely on simplifying the relationships between plant and the other components of the natural habitat, which should facilitate the control of agricultural ecosystems. Most studies conducted over time claim that agricultural intensification and agricultural land conversion lead to a decrease in soil organic matter (SOM), leading to the loss of soil biodiversity [12, 24]. Also, the widespread use of pesticides can have, directly or indirectly, a negative effect on soil biodiversity, but the data obtained so far by different authors have led to contradictory results [11, 19].

SOM, especially through its stable fraction (humus), plays an important role in climate change mitigation and adaptation [9]. Both the amount and the types of SOM are determined mainly by the continuous chemical and physical action of soil microorganisms. In the process of transformation and decomposition of MOS, an essential role is played by soil fauna and microorganisms [4, 6].

Agricultural lands and crops are vulnerable to climate change, changes that manifest themselves on the environment, with increasingly obvious repercussions in the near future [13].

Many crops are at risk due to the reduction of the amount of precipitation and its uneven

distribution during the growing season, factors that will contribute in the near future to an increase in aridity and desertification of soils, ultimately contributing to a degradation of the structure of the soil and the content of organic matter in the soil, of micro and macronutrients, elements with an essential role in the growth and development of plants [2, 10, 20].

Intensive agriculture involves carrying out a greater number of soil works, which over time degrades the soil, affecting the stability of structural microaggregates, elements that play a key role in the formation of organic matter and support long-term carbon sequestration, being more stable than macroaggregates [6].

This, leading to an increase in the use of mineral fertilizers and pesticides, requires continuous and energetic tillage to be able to replace the activity of the soil fauna and the loss of SOM. [5, 19].

The studied area is located in the centre of Timiş County, on DN 6, at a distance of 12 km from the Municipality of Timişoara and 47.7 km from the Municipality of Lugoj.

The studied area covers an area of 7,289 ha, of which 5,956 ha is agricultural land. Its relief is represented, in general, by plains (the Tisa Plain) and hills (the Western Hills) [13, 22].

The hilly sector occupies the part located NE of the village of Ianova, in the form of a succession of hills, 300-400 m wide, slopes with 3-20% inclination that, sometimes, fall in steps towards the meadows and micro-meadows of the erosion valleys, which reach widths between 500-600 m [14, 21, 22].

The altitude of the hills is between 150-200 m; the plain area, which occupies most of the territory, has an altitude of 75-120 m in the plain sector and 80-90 m in the meadow sector, the latter being interspersed with numerous deserted meanders, with marshy depressions and shingles which provide, both through the soils and the presence of shallow groundwater, good lands for the practice of agriculture [1, 19].

The climate, moderately temperate-continental, can be characterized as a lowland climate, at the limit of interference between the western subtype with oceanic nuances and the Banat subtype with sub-Mediterranean nuances [8, 14].

The average annual temperature is 10.8°C, and the average annual amount of precipitation is 600.4 mm (Timişoara Meteorological Station), with the mention that, if there is a deficit of rain moisture in the summer period, surpluses of water are recorded during the rest of the year both in the soil and on its surface, with negative influences on the balanced development of agricultural crops [13, 23].

## MATERIALS AND METHODS

For this study, data from the OSPA Timişoara, from previous research, from specialized literature, and especially data from own observations made in the field and in the laboratory were used [17].

A series of physical, physical-mechanical and chemical analyses of the seven identified soil types were made [3].

Profiles were dug and soil samples were collected in a disturbed structure to determine the physical, physical-mechanical and chemical indices of the soils.

The measurements were made according to the current methodology.

The granulometric composition of each type of soil was determined and the texture class, density and apparent density values were determined; porosities and degree of settlement of each soil were calculated, as well as humus content, soil reaction, total nitrogen content (%), mobile phosphorus content (ppm), and mobile potassium content (ppm) over the 0-20 cm profile.

Depending on the values of these indices (physical, physical-mechanical and chemical), on the presence of phreatic or stagnant water in the soil, the main limiting factors were established, which limit to a lesser or greater extent, depending on their presence in the soil and on the degree of manifestation, soil fertility and quality [8].

## RESULTS AND DISCUSSIONS

The total area of Remetea Mare is 7,289 ha, of which 5,956 ha (81.71%) is agricultural land,

586 ha (8.04%) is occupied by forests and 747 ha (10.25%) have other categories of use as presented in Table 1 and Figure 1.

Table 1. Land use in Remetea Mare

| Land use | Ha | % |
|---|---|---|
| Arable | 5,956 | 81.71 |
| Grasslands and haymaking fields | 168 | 2.30 |
| Orchards | 32 | 0.44 |
| Forest | 747 | 10.25 |
| Forested grasslands | 386 | 5.30 |
| Total | 7,289 | 100 |

Source: Own calculation.

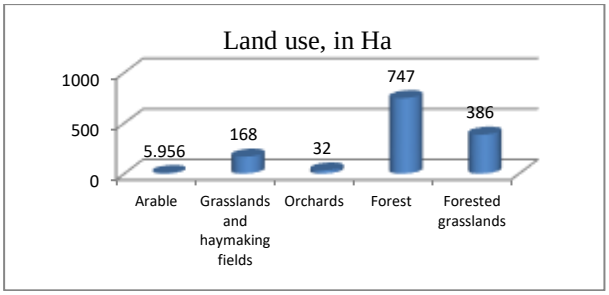


Fig. 1. Land use in Remetea Mare
Source: Own calculation.

Within the locality, there are 122 units with legal personality, in different fields of activity, most of them agricultural. The most common crops are represented by wheat, maize, followed by soy, rapeseed, barley, oats, alfalfa, potatoes, fruit trees – among which walnut, plum, apple and cherry prevail (Photo 1 and 2).

Photo 1. Wheat crop
Source: Original photo.

Photo 2. Corn field
Source: Original photo.

The genesis and evolution of soil types are directly related to climate and vegetation conditions, to the natural subsidence of the relief, to the influence of groundwater, as well as to human intervention. Currently cultivated plants cover almost the entire range of agricultural crops practiced in the Western Plain of Romania.

The grouping of land units has led to the identification of the dominant types of soils shown in Table 2 and Figure 2.

Table 2. Soil classes and types identified in Remetea Mare

| Soil class | Soil type | Area (%) |
|---|---|---|
| Cernisols | Phaeozem | 38.3 |
| Luvisols | Luvisols | 8.3 |
| Cambisols | Eutricambosols | 9.6 |
| Hydrisols | Gleysols | 19.2 |
| Hydrisols | Stagnosols | 4.3 |
| Vertisols | Vertosols | 8.4 |
| Protisols | Aluviosols | 11.9 |

Source: Own calculation.

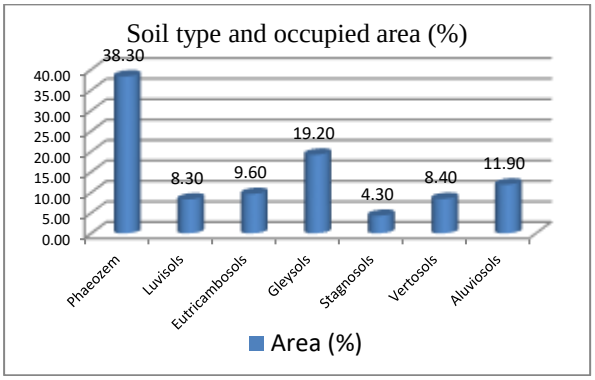


Fig. 2. The type of soil in Remetea Mare and the area in %
Source: Own calculation.

Because of the mineralization of the largest part of the annual organic remains in the upper part of the soil, a small amount of humus is formed and, as a result, the colour of the upper horizon formed in the soils found in the studied area is brown, which gives rise to the formation of an Ao – A ochric soil layer: this has led to the formation and evolution of most of the soils encountered (Luvisols, Eutricambosols, Gleysols, Stagnosols, Vertosols and Fluvisols).

Only to a lesser extent, on flat surfaces, with a more pronounced accumulation of organic matter, a dark, blackish-coloured soil layer

was formed, which has given rise to a soft Am – A mollic soil layer, characteristic of Phaeozems, soils that occupy 38.3% of the arable area.

Following laboratory analyses, the following physical properties of these soils were determined (Tables 3 and 4 and Figures 3, 4 and 5).

Table 3. Granulometric composition of the soils from the Remetea Mare locality

| Soil type | Coarse sand (2.0-0.2 mm) % | Fin sand (0.2-0.02 mm) % | Dust (0.02-0.002 mm) % | Clay (< 0.002 mm) % | Texture class |
|---|---|---|---|---|---|
| Phaeozems | 2.8 | 40.0 | 28.9 | 28.3 | LL |
| Luvisols | 2.8 | 37.9 | 32.0 | 27.3 | LL |
| Eutricambosols | 6.90 | 39.20 | 32.70 | 21.20 | LP |
| Gleysols | 0.3 | 30.6 | 34.8 | 34.3 | TT |
| Stagnosols | 0.8 | 29.1 | 30.6 | 39.5 | TT |
| Vertosols | 0.2 | 9.4 | 14.8 | 75.6 | AF |
| Aluviosols | 33.3 | 30.4 | 16.1 | 20.2 | SG |

Source: Own calculation.

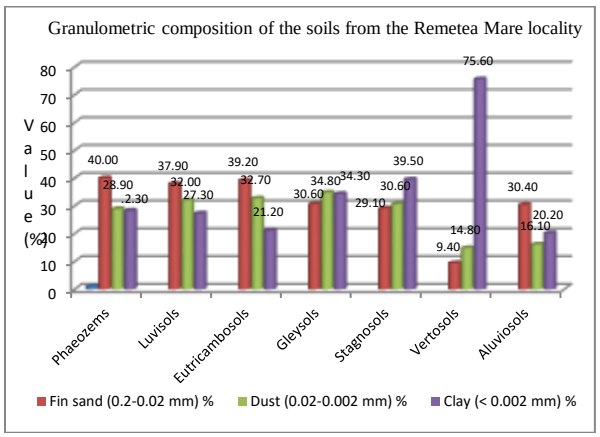


Fig. 3. Granulometric composition of the soils from the Remetea Mare locality
Source: Own calculation.

The granulometric composition of the soils is loamy (LL) in Phaeozem and Luvosol, loamy-dusty (LP) in Eutricambosol, medium-fine (TT) in Gleysol and Stagnosol, clayey-fine (AF) in Vertosol and coarse (SG) in Alluvial soil, respectively.

The biggest problems, because of the fine and coarse textures, are in Vertosol and Fluvisol; in Gleysol and Stagnosol, because of the presence of shallow groundwater and of the pooling of water from precipitation, respectively, have a low natural fertility.

Table 4. Physical and physical-mechanical properties of the soils in Remetea Mare

| Soil type | Density (g/cm$^3$) | Apparent density (g/cm$^3$) | Total porosity (%) | Aeration porosity (%) | Subsidence degree (GT%) |
|---|---|---|---|---|---|
| Phaeozems | 2.68 | 1.39 | 48.13 | 16.20 | +5 |
| Luvisols | 2.69 | 1.63 | 39.41 | 0.34 | 24.53 |
| Eutricambosols | 2.58 | 1.67 | 35.3 | 8.84 | 28.0 |
| Gleysols | 2.45 | 1.39 | 39.38 | 10.16 | 26.10 |
| Stagnosols | 2.67 | 1.62 | 38.32 | 2.58 | 20.26 |
| Vertosols | 2.43 | 1.29 | 47.0 | 1.59 | 22.54 |
| Aluviosols | 2.62 | 1.50 | 43.10 | 19.85 | 11.10 |

Source: Own calculation.

The physical properties of soils are also influenced by soil texture, which leads to an increase in density and apparent density values in the case of Phaeozems, Luvisols, Eutricambosols, Stagnosols and Vertosols whose total and aeration porosities fall well below 40% total porosity (35.3-39.41%) at very low values of aeration porosity, values ranging from 0.345% in Luvisols to 19.85% in Fluvisols.

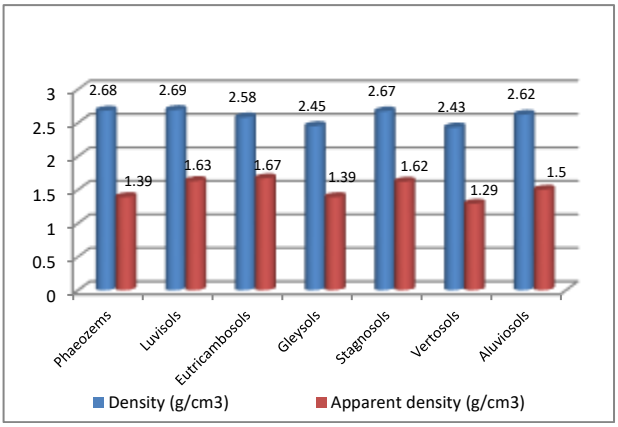


Fig. 4. Physical properties of the soils in Remetea Mare
Source: Own calculation.

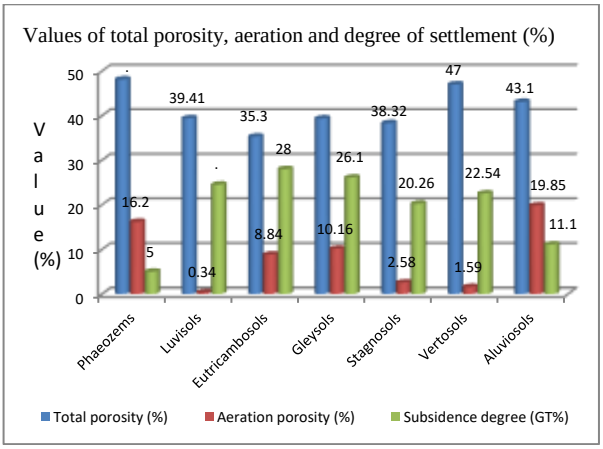


Fig. 5. Physical and physical-mechanical properties of the soils in Remetea Mare
Source: Own calculation.

The soils with the highest degree of subsidence are Luvisols with 24.53%, followed by Gleysols with 26.10% and Eutricambosols with 28.0%. Fluvisols with 11.10% and Phaeozems, which, at a depth of 0-20 cm, show a degree of subsidence of only 5%, are at the opposite pole.

Table 5 and Figure 6 and 7, shows the main chemical properties of soils.

Table 5. Chemical properties of the soils in Remetea Mare

| Soil type | $H_2O$ pH | Humus (%) | Total nitrogen (%) | Mobile phosphorus (ppm) | Mobile potassium (ppm) |
|---|---|---|---|---|---|
| Phaeozems | 6.86 | 3.84 | 0.350 | 117.4 | 182 |
| Luvisols | 5.29 | 1.61 | 0.116 | 11 | 87 |
| Eutricambosols | 6.45 | 2.43 | 0.140 | 25 | 350 |
| Gleysols | 6.82 | 5.75 | 0.258 | 40 | 130 |
| Stagnosols | 6.18 | 4.27 | 0.208 | 38 | 180 |
| Vertosols | 6.50 | 3.41 | 0.308 | 67 | 320 |
| Aluviosols | 5.55 | 2.79 | 0.259 | 15 | 70 |

Source: Own calculation.

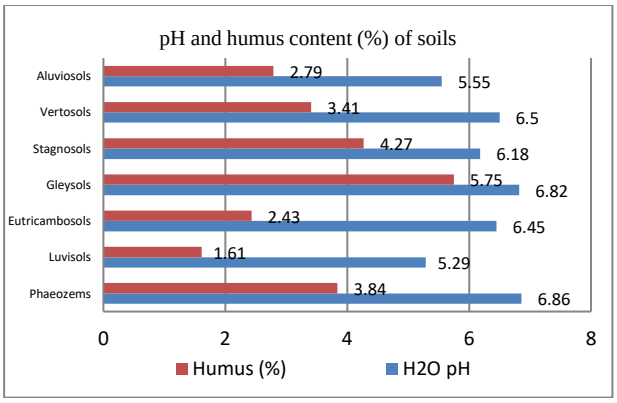


Fig. 6. pH and humus content (%) of soil from Remetea Mare

Source: Own calculation.

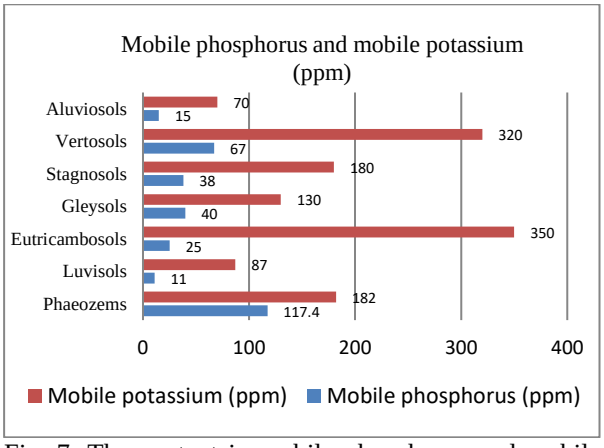


Fig. 7. The content in mobile phosphorus and mobile potassium (in ppm) of soils from Remetea Mare

Source: Own calculation.

Data presented above show that Luvisols and Fluvisols have a low pH, i.e., a rather high degree of acidification, which limits their fertility (quality) and their use as agricultural land. On these soils, it is recommended to amend the soil with calcium-based amendments to reduce their acidity level, thus increasing their quality and fertility. The humus content of the soils is between 1.61% in Luvisols and it reaches 4.27% in Stagnosols and 5.75% in Gleysols, respectively, which are also the soils that raise the most problems from a qualitative point of view. Vertosols, whose content in humus is 3.41%, being medium supplied in humus, also have low fertility because of the presence of the clay fraction in high proportions (75.6%), which makes them unsuitable for fruit trees and hoeing plants where soil humidity is not constant. In the years when there with a shortage of water in the soil, very large cracks (more than 2 cm in diameter) appear on the surface of these soils, which often crack the roots of plants, reduce capillarity and increase the degree of subsidence.

The total nitrogen content is between 0.116% in Luvosol, 0.208% in Stagnosol and 0.350% in Phaeozem, respectively. The most abundant total nitrogen content is in Phaeozems, followed by Vertosols and Fluvisols. Mobile phosphorus content has values between 11 ppm in Luvisols and 117.4 ppm in Phaeozems, while mobile potassium content is between 70 ppm in Fluvisols, 320 ppm in Vertosols and 350 ppm in Eutricambosols, respectively.

These results show that, in general, soils have a different production capacity, this diversity being influenced by a series of limiting factors, the most important of which are soil reaction, humus reserve, excess surface and water table moisture, fine texture, land slope, and degree of subsidence.

These limiting factors that obstruct the optimal exploitation of the soil are represented differently and affect the quality and fertility of the soils in a different way: the phenomenon of acidification, because of the reaction of the soil, affects 83.97% of the agricultural area of the locality (moderate 48.3%, reduced 35.67%), the humus reserve

in the proportion of 55.1% (moderate 18.2%, reduced 36.9%), the degree of subsidence of 87.56% (severe 67.06%, moderate 20.5%), the fine texture (reduced 62.2%), the land slope, 13.8% (moderate 4.1%, reduced 9.7%), the excess groundwater 56.67% (very severe 18.3%, severe 26.8%, moderate 9.3%, reduced 2.27%) and surface water 53.89% (very severe 8.3%, severe 21.6%, moderate 15.8%, reduced 8.19%).

Depending on these limiting factors and on their properties, the soils encountered within the studied area were classified into the following quality (fertility) classes for the "arable" use category: class II 583 ha (6.7%), class III 3,744 ha (43.0%), class IV 3,234 ha (37.1%) and class V 1,152 ha (13.2%).

As far as the restrictive elements mentioned are concerned, periodic amendments with calcium, deep loosening, improving fertilizing, ploughing along the level curve (in the hill area) and hydro-ameliorative works for aiming at drying and evacuating the excess groundwater and rainfall water are necessary on a case-by-case basis (in low meadow areas).

## CONCLUSIONS

The content of the soil in nutrients, the pH, the granulometric composition (texture), the structure, the content in humus, the state of gleization, stagnogleyzation, the degree of subsidence, etc. particularly influence the life of the agroecosystems, all together representing the expression of the long-term interaction between vegetation and environmental conditions. The degree of soil supply with nutrients is of particular importance for the structure and productivity of the crops: the productive potential of the phyto systems can be valued, under normal conditions, by the supply with nutrients and water.

In different pedological and climatic conditions, the agricultural production that is obtained in an intensive agriculture, requires a detailed knowledge of the soil properties and the climatic, anthropogenic and ecological factors.

The soil is constantly subject to a complex of factors, represented by light, heat, precipitation, relief, lithology, hydrology, biological, physical, chemical, water properties, etc., factors that change in time and space and that are found in the productive capacity of agricultural lands, respectively in the degree of fertility (quality) of the soils. Choosing the most appropriate exploitation technologies and taking conservation and improvement measures, by applying fertilizers and amendments, in appropriate doses, lead to an increase in productivity.

The natural fertility of the soil is an important factor in the formation and evolution of the soils in this area. The agricultural lands in that area have always been fertile, and provided food for people and animals and the sale of agricultural products (processed or as raw material). Since ancient times, the land of this area has been fertile, providing food for both humans and animals, and for the marketing of products, either processed or as raw materials.

The fertility of Fluvisols is extremely varied from one soil subtype to another or from one variety to another. The calculation of average values cannot certify the state of evolution or existence of the soils at this stage. In general, and excluding the entic subtypes, alluvial soils have a satisfactory, in some cases even good, quality. For example, batigleyc Fluvisols with balanced granulometric composition are classified in class II.

The fertility of eutricambosols is medium, but it can be increased through proper fertilization and quality soil works.

The fertility of gleysols: in principle, the excess of moisture limits agricultural crops, but after hydro-ameliorative works, they can be cultivated successfully.

The fertility of vertosoils is quite low, because of the presence of sliding faces on the structural elements.

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# ECONOMIC ANALYSIS OF THE TYPICAL RURAL AREAS IN BULGARIA

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***Abstract***

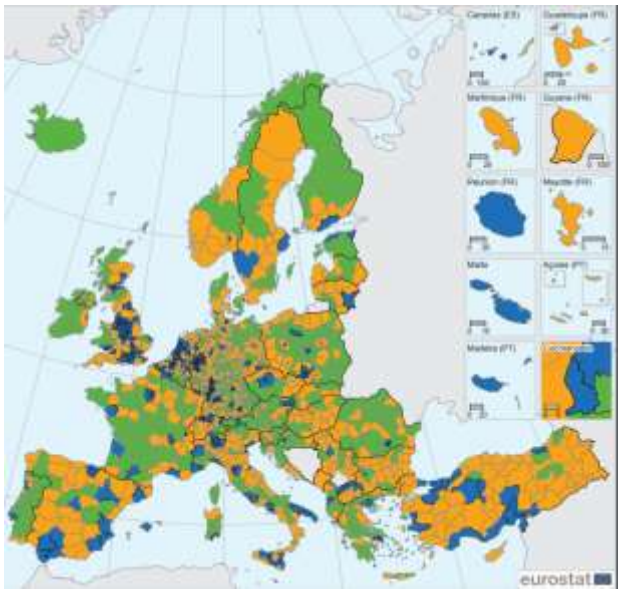
*Rural areas are taking an important and significant share of the EU. Bulgaria is not an exception and it is important to periodically review and analyze Rural areas` progress on certain parameters, such as GDP per capita, foreign direct investments, tangible fixed assets acquisition costs, coefficient of economic activity, etc. The main goal of this article is to review the progress for a period of 5 years in the typically Rural areas in Bulgaria according to classification NUTS 3 and draw possible future goals for better regional and rural development. The research is based on the official national statistics in Bulgaria and Eurostat. After processing the data, main results are showing higher statistical values in some of the analysed parameters, like GDP and average output of non-financial enterprises. We can conclude that even these results are better in last few years, there is need of more stable tendency, so we can consider the typical rural areas as fast developing regions in Bulgaria.*

***Key words*****:** *Rural areas, Bulgaria, GDP*

## INTRODUCTION

Villages and rural areas fall into the agenda of various analyses, assessments and policies.
They present a research field for the study and analysis of new models of economic, civil and social behaviour, and as such, remain at the center of our attention, not only as a source of agricultural products and foodstuffs, but as an asset and social welfare, with their unquestionable values – natural environment and landscape, open spaces, unique way of life, material and spiritual culture, place for recreation, tourism and rest (Georgieva-Stankova et. al., 2018) [4].
The typology "urban-rural territories" is presented by Eurostat in the Guide to typologies of regions (Applying the Degree of Urbanisation, 2020) [1, 2].
The etymology of the term urbanization is very complex, there are different interpretations of a large number of authoritative scholars dealing with this matter.
Regional Science has an important role to play in providing decision makers with evidence-based research that meets the challenges of the post-urban world.(Westlund, H. and Borsekova, K., 2023)[11].
The word comes from the Latin urbs, hence the adjective “urban” in translation - urban or more urban.
In the 14th century the term “urbanity” enters in the literature as a concept, referring to the emergence and development of cities (Marinov, P., 2021) [6].
There are three types of approach to classify urban and areas rural NUTS 3 regions.
The first step is to identify the population in Rural areas: "Rural areas" are all areas outside urban clusters. "Urban clusters" are groups of contiguous grid cells of 1 km² with a density of at least 300 inhabitants per km² and a minimum population of 5,000.
In the second step, NUTS 3 regions are classified as follows, based on the proportion of their population in rural areas:
-"*Predominantly rural*" if the share of the population living in rural areas is higher than 50%
-"*Intermediate areas*" if the share of the population living in rural areas is between 20% and 50%
-"*Predominantly urban*" if the proportion of the population living in rural areas is less than 20.

In a third step, the size of urban centers in the region is taken into account.
A predominantly rural region that contains an urban center of more than 200,000 inhabitants, constituting at least 25% of the region's population, becomes intermediate.
An intermediate region that contains an urban center of more than 500,000 inhabitants, constituting at least 25% of the regional population, becomes predominantly urban.
In 2018, the OECD produced a new typology complementing the previous typologies by introducing the concept of *functional urban areas* to better reflect the link between rural and urban areas (Féret, S. et. al., 2020) [3].
The image of the urban-rural regions in the EU is shown in Map.1.



Map 1. Urban-rural typology regions in EU in 2022
Source: Eurostat, 2023 [2].

The social and economic status of each region, its development programs, as well as national strategies and plans must be taken into account when planning the goals and objectives for sustainable development (Marinov P., 2020) [5].
It is important to define that all regions in Bulgaria according to NUTS 3 level are 28 and they are matching with the districts of the national regions division.


Map 2. Rural-urban territories, LAU 1, Bulgaria
Source: Spatial concept of Bulgaria(2013-2025) [10].

More than 80% of the territory of the country is rural and you can see the exact distribution to Figure 2 (NSRD, 2019) [7].
In this context, the purpose of the paper is to analyse the economic status of the typical rural areas in Bulgaria using specific indicators.

## MATERIALS AND METHODS

The tasks for accomplishing the research goals include 1) selecting proper territory type – typical Rural areas in Bulgaria; 2) collect and classify the information based on the official National Statistical Institute; 3) analyzing and processing the information, followed by conclusions for the economic status of the rural areas.
The regional cut in the research methodology is based on the Gross Domestic Product per capita in Bulgaria. The area of research includes seven regions and they all are classified as same type.
In order to guarantee the proper information processing, following methods are used: analysis and synthesis; inductive, deductive and translational methods; grouping, systematization, classification; statistical methods for characterizing dynamic and variation statistical series; structural analysis; econometric methods; cluster analysis.

## RESULTS AND DISCUSSIONS

**The average Gross Domestic Product per capita (GDP)** for all seven typical rural areas was just over 64% of the national average in 2015 and fell to over 63% in 2021, due to the

fact that the GDP per capita in rural areas is growing more slowly than the national average.

The average GDP for rural areas reached BGN 12,449 in 2021. Of course, there are differences between the districts, which are not significant, but we can note that some of the rural districts have a higher growth rate than the average for the seven regions (61.1%) and the average for the country (62.4%). These are Kardjali (81.9%), Vidin (82.2%), Razgrad (67.1%). The lowest growth rate of GDP is in the regions of Smolyan (43.9%) and Sofia region (45.3%).

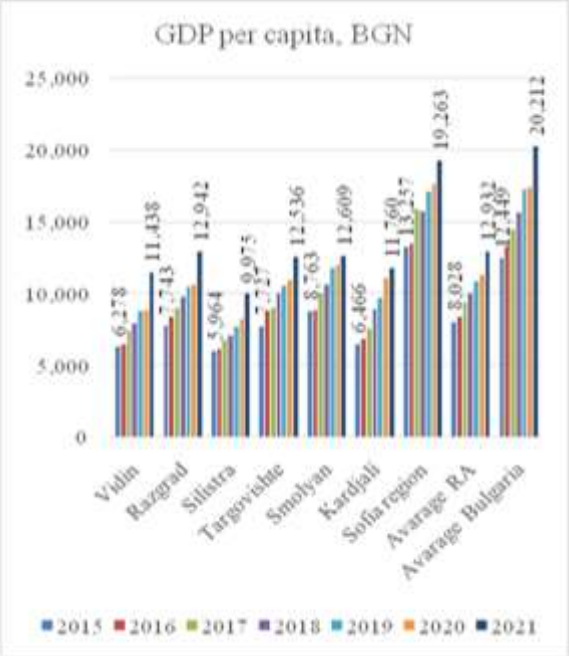



Fig. 1. Gross domestic product per capita, BGN
Source: NIS [8].

However, the growth of the cultivated goods per capita in the rural areas is the result not only of an increase in the production of goods, but also of the unfavourable trend of decreasing the number of the population, with the exception of the Kardjali region ( Fig. 1).

**The average Economic Activity Coefficient (EAC) for rural areas** (2015-65.8%, 2021-67.8%) is lower than the average for the country as at the beginning of the observed period (2015-69.3%), and at the end of the period (2021-72.0%) (Fig. 2).

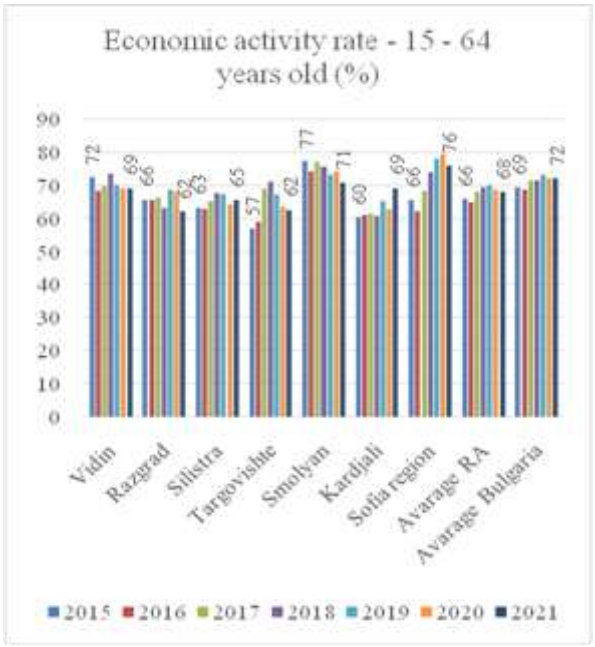



Fig. 2. Economic activity rate - 15 - 64 years old (%)
Source: NIS [8].

There is a decrease in the difference, albeit very poorly-in 2015 the EAC index in the rural areas compared to the national average is 94.9%, and in 2021 it is 94.2% i.e. the economic activity coefficient increases faster in rural Areas than average in the country. However, this is also related to the higher rate of population reduction in these regions. An exception is the Kardjali district, where the population is increasing. The most unfavourable are the trends in the districts of Vidin and Smolyan, where we monitor a decrease in economic activity.

Undoubtedly, the adverse demographic indicators of Vidin region are caused and directly related to the increased net outgoing migration, which affects the reduction of the EAC of the area for the observed period. An increase in EAC was observed in Sofia-region (15.7%), with this temp ahead of the country average rate (3.9%), Targovishte (10%) and Kardjali (14.4%). From the other hand there is decrease to the EAC for districts: Vidin, Razgrad and Smolyan. It is important to point out that only in these areas (without Silistra) we have a net incoming migration, leading by Kardjali region (2016 to 2021), Targovishte (net incoming in 2021), Sofia region (net incoming in 2015) ( Fig. 2).

**The average Foreign direct investments (FDI) for rural areas**

FDI value is almost three times lower than the average for one area in the country throughout the observed period- 2015- 2.97 times, and 2021- 2.72 times.

FDI in rural areas has increased by 2018, and in 2019 they decreasedcomparedto 2018, but still we have higher than all previous years and to the end of the period in 2021. All seven rural areas are one quarter of the districts in the country (28), and they make up only approx. 10% of all FDIs in 2021 in the country. In each individual rural region, an increase in the FDI is reported, with the exception of the districts of Razgrad and Vidin.

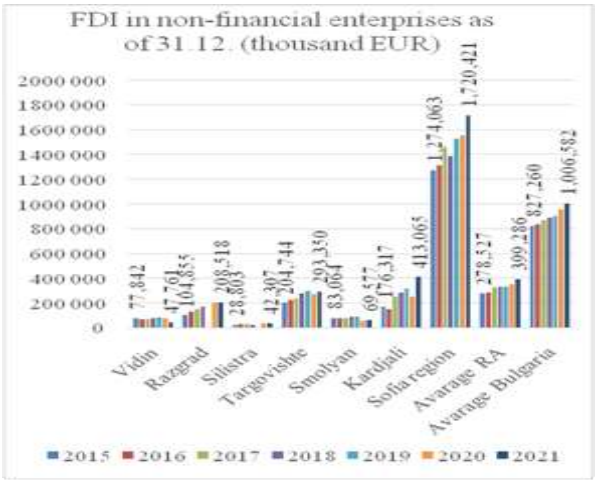



Fig. 3. FDI in non-financial enterprises as of 31.12. (thousand EUR)
Source: NIS [8].

It is a fact that the growth of FDI in rural areas (43.4%) is higher than the increase for the country (total and average per district) (21.7%).The largest is the rate of increase of FDIs in the district of Kardjali (by 134 %) and the Razgrad region (100%), and this rate is ahead of the rural average for the growth rate of the FDI for the five years, which is related to the net incoming migration and the investments coming mainly from Turkey. The other areas in which FDI increases are Sofia region and Targovishte. They also have a higher growth rate than the national average, but still as a level of FDI there are lagging there behind the leaders mentioned before. We have to also declare two regions with negative result for the period and these are: Vidin and Smolyan, with results respectively (-62% and -20%). There is decreasing trend monitored for Vidin district as the FDI are still lower than the average for the country. (Regional profiles, 2021) [9] (Fig. 3).

**The average cost of acquiring tangible fixed assets (CTFA)** for rural regions is two to three times lower than the average for one region in the country during the entire observed period - 2015 - 2.06 times, 2016 - 2.91 times, 2019 - 2.4 times and in 2021 the difference is 2.89.

CTFA in rural areas decreases until 2016, and then an increase is reported, but not in all areas the levels from 2015 are reached.

In four of the rural areas (Razgrad, Kardjali, Smolyan and Sofia region) an increase in CTFAwas reported for the observed period (2015-2021), and the increase in Kardjali region is remarkable – more than 3 times and reaching 78.8% compared to the average level in the country for 2019 (the value of Kardjali - 615,854 thousands, BGN., Bulgaria - 781,203 thousands, BGN), which is the main result of Turkish investment in 2019. In the remaining three regions (Vidin, Silistra and Targovishte) a decrease in this indicator is observed.

The very high result for the region of Targovishte in 2015 is related to the construction of the capacity of the factory "Trakia glass Bulgaria" part of the Turkish company "Shishedjam" near the regional center.

CTFA in the Vidin region are mainly in the agricultural sector. Average for the seven rural regions also has a decrease (with 29%). Seven rural areas contribute with 8.6% to the CTFA in the country in 2021.

However, this does not have a negative impact to digitalisation and for example the internet access in rural areas is increasing to 34% above the national average (27%) and above the EU average (11%) Fig. 4).

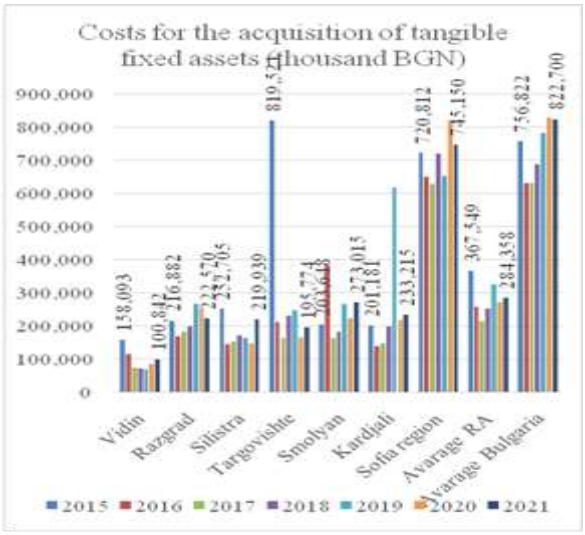



Fig. 4. Costs for the acquisition of tangible fixed assets (thousand BGN)
Source: NIS [8].

**The average output of non-financial enterprises (ONFE)** for rural areas is 2.5 times lower than the average for a region in the country both at the beginning of the observed period (2015) and at the end of the period (2021).

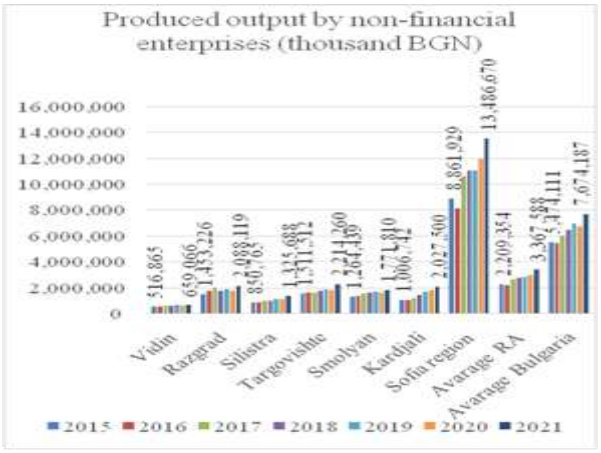



Fig. 5. Produced output by non-financial enterprises
Source: NIS [8].

The value of the produced products in rural areas reached in 2021 – 3,367,588 thousand BGN. Regarding the dynamics, it is clear that the rural areas show a growth in ONFE (with 52%), which also corresponds to the average rates for a region in Bulgaria, it is even higher than the average for the country value (40%).
The differences between the typical rural regions are not significant, with the exception of the Kardjali region, where the ONFE has doubled its value compared to the start of the monitored period.
The lowest growth rate of ONFE is in the Vidin (27%) and Targovishte region (46%), which, however, does not differ significantly from the rest of the rural regions and from the average for a region in the country (Fig. 5).

## CONCLUSIONS

All indicators reviewed above are giving a global picture of the typical rural areas in Bulgaria. The analysis and evaluation of the obtained economic results allowed the opportunity to outline several general conclusions and recommendations, as follows:

- We can conclude that although the GDP is increasing, it is still lower than the average for the country and it is not enough one or more rural regions to be above the average values and this cannot lead to a tendency of increasing quality of live and better services in these areas.
- It is a good sign that we do have similar result for the economic activity rate in the rural areas compared to the country levels. Form the other hand the investments and the cost of acquiring tangible fixed assets is not very high and this is giving us a feedback that there are not enough investments in the local economy.
- After the pandemic situation related to COVID-19 lockdowns and multiple measures taken by the governments, there is a clear indication that the Foreign direct investments are with lower temp than the average for Bulgaria and also one of the lowest on European union level.
- Location is the main factor regarding the produced output by non-financial enterprises. It is visible from the analysis that Sofia region is with higher results than all other rural areas. So as closer as you are to a big city, more production could be generated and released to the markets.

Despite the mostly negative results for the main economic indicators, we have to also mention that there is positive influence from the most recent changes and more local companies updated their internal labor

regulation that are allowing them to pass through the crisis periods. Many of them allowed remote working positions (where it is possible to be applied), others became more flexible from location point of view and these changes led to positive changes in their end production achievements. Lastly, we cannot deny that in 2021 for most of the indicators, we do have inspiring results and that will lead to even better progress in next years.

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# ENVIRONMENTAL AND AGRIFOOD CULTURAL TRADITION PRESERVATION AS PART OF RURAL TOURISM. A SYSTEMATIC LITERATURE REVIEW IN ROMANIA

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***Abstract***

*The terms rural tourism and agritourism can be considered synonymous, but there are differences even though they share certain identifying elements. Agritourism appeared as a solution to in-crease the income of rural households, by capitalizing on their economic potential, however the main activity remained agriculture. The main purpose of this research is to evaluate the situation of agritourism in Romania approached from different perspectives such as: rural development, traditional products, and landscape integrations. The methodology used in this study is a systematic literature review where the search process was carried out using keywords such as: "Agritourism in Romania" or "Rural development in Romania" or "Integration of the rural landscape in Romania". The research was conducted and filtered through the Prisma guidelines in 30 papers that were highlighted in the Results section. In concluding this research paper, we would like to say that there are many factors that should be considered to find a viable solution to help develop rural communities and simultaneously safeguarding the environment and using natural resources responsibly.*

***Key words*:** cultural background, traditional methods, integration of the rural landscape, rural areas improvement

## INTRODUCTION

Although the first records of the use of rural regions for recreation date back to the 19th century, the growth of agritourism in the nations of the European Union and in Romania began in The 1990s [55, 57]. The agritourism industry expanded quickly in the 1990s, notably in Europe. Austria, Germany, Great Britain, France, and Ireland are the five European nations with the most agritourism facilities; they are also the countries with the best-organized agritourism sectors. Rural areas are vital for the European Union (EU), as they cover almost 88% of the territory and account for 59% of the population. In Ireland, Slovenia, and Romania, more than half of the people live in rural areas [16]. The guiding principles of balanced rural development, taking into account the sustainable growth of the agricultural sector, are highlighted in the European Charter of Rural Areas from April 1996. The charter is applicable to the entire continent of Europe and is based on the multifunctional development of rural areas as well as the sustainable exploitation of the natural resources that are already available, keeping in mind that the majority of the food consumed by Europeans, particularly their raw materials, comes from these areas [15].

The liberalization of trade, the development of communication technologies, and the consolidation of rural development policies have determined major changes for rural areas from an economic and social point of view [20, 27]. Agriculture no longer represents the main pillar of the rural economy, and this aspect is widely known, the contribution to the gross domestic product (GDP) and

employment in most rural areas is in relative decline [17, 33]. There are major changes in the economy and social environment of rural areas in the European Union. The need for a change in rural areas by diversifying the basic economy seems to be the only answer to survive socio-economically [20, 51]. Agritourism has quickly developed all over the world, but mainly in Europe. Austria, Germany, France, and Ireland are the European nations with the most agritourism facilities; each of these nations has a well-managed agritourism industry [54]. In contrast, only a small portion of the population in some of the most populated Member States, such as Germany (22.4%), Italy (18.9%), Belgium (18.0%), the United Kingdom (14.9%), and the Netherlands (14.7%), resided in rural areas. Comparatively speaking, Romania is contentious and has enormous potential for agritourism business development, but at the same time, at least 50% of the rural people faced the threat of poverty or social isolation in 2015 [7].

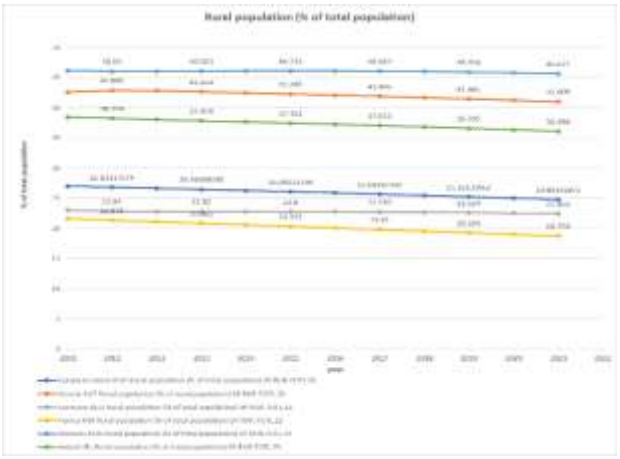

Fig. 1. Rural population (% of total population) - European Union, Romania, Ireland, Austria, Germany, Source: World Bank Data [58].

According to World meter's interpretation of the most recent United Nations data as of Monday, January 23, 2023, the population of Romania is currently 18,910,525 people.

There are 230,170 $km^2$ of land in all, and 54.6% of people live in cities (10,507,365 people in 2020). In Romania, the average age is 43.2 years.

Rural areas need the optimization of completeness which would translate into supporting the rural community and encouraging the diversification of economic activity in the rural environment [27], and focus on the main 3 coordinates: people, space, and products [51, 2]. The landscape and the wealth of local resources, which constitute recreational features and ensure cultural, spiritual, and ecological growth, attract many tourists [31, 43]. Like other regions of Europe, rural areas in Romania have experienced a decline in agricultural activities, the restructuring of rural society, and with the rising abandonment of agricultural land as a result of the aging of the rural population and young people's movement to metropolitan areas or overseas, to nations in the continent's center or west [25]. The viability of rural regions is threatened by the aging of the rural population, among all these effects.

These days it is more and more important to find a second income beside agricultural activities, and agritourism entrepreneurship has a great potential to generate and support economic growth and contribute to sustainable development. [3, 23, 29, 55]. Beside increasing the number of jobs there is a great opportunity to promote local food and values and to conserve the cultural landscape, which help to create the specificity of an area [37]. During the last years, there was a tendency of people relocating in the rural areas, due the pandemic and the rise of the prices this moment intensifies [36, 19]. There is a need for modern people to reconnect with their roots, to have freedom of movement and to grow their own food. Different types of people are relocating, and this comes with pros and cons, but there are several studies pointing out that agritourism and sustainable farming has become a viable solution.

The Carpathian, Subcarpathian, hills, plateaus, plains, meadows, and the Danube Delta make up Romania's relief. Their weights are indicated as follows: 31% mountains, 36% hills and plateaus, and 33% plains and meadows. They are grouped concentrically in the shape of an amphitheatre. There are 13,008 villages overall, of which 522 are part of municipalities and cities, according to the Annex that was modified to Point 9, Article I,

of Law no. 290 of November 29, 2018, which was published in the Official gazette no. 1052 of December 12, 2018. These villages are organized into 2,861 communes, each of which is made up of one or more villages. Rural areas often have lower population densities than urban areas, with an average density of 47.7 inhabitants per $km^2$ compared to 84.8 residents per $km^2$ in urban areas [5]. Rural Tourism is described by UNWTO as a specific type of tourism where a large range of items, often connected to outdoor recreation, farming, country living, fishing, and tourism, affect the tourist experience.

A significant component of rural tourism is agritourism, which helps meet visitor demands by providing them with experiences and goods created in-house.According with the Romanian legislation, an Agritourism guesthouse is described as a tourist reception structure, with an accommodation capacity of up to 8 rooms, operating in citizens homes or in an independent building, which offers accommodations for visitors in specifically created areas, the means to prepare and serve meals, as well as the opportunity to engage in domestic or artisan activities [56].The National Institute of Statistics (NIS) has provided statistics in which both types of lodging structures have an upward trend, with the guesthouse trend remaining constant while the agri-pension trend accelerates. Nevertheless, there are now twice as many agri-pensions as there were ten years ago, and there are now 410 additional housing facilities. The type of services that lodging facilities provide may hold the key. In recent years, there has been a trend toward returning to one's roots, getting closer to nature, and engaging in activities that are typically out of one's daily schedule. Agri-pensions have the benefit of offering wholesome, traditional foods and goods while reviving childhood memories for those who were raised by grandparents or urban residents (whether foreigners or not) who yearn to learn about these experiences.

After 2009, when there were 7% more tourist and agritourism pensions than the year before, the recession slowed the growth to just 1% in 2010 and their numbers even started to decline in 2011. Beginning in 2014, tourism will begin to rebound, and both pension and agro-pension new housing units will begin to emerge. The number of rooms available for tourists increased by 1.8% annually on average, but 2017 was the most significant year in terms of their growth, with a 4.5% increase on July 31 compared to the same period in 2016 [22]. In recent years, there has been a lot of interest in the development of rural areas. In addition to the rise in accommodation structures, many projects have been launched with the goal of preserving and restoring the traditional architecture of old homes, learning more about how our ancestors lived, and discovering the authenticity of local customs, foods, songs, legends, and crafts. For an accurate answer, the rural region must be analyzed as a complex system that involves all the domains. In addition to academic re-search, there are numerous NGOs that work to preserve the communities (La Origini, Scoala Trimitoare, Scoala de la Bunesti, Ryma Association with projects in Alba Iulia citadel and Cornea, Herculane Project, Summer school at the Palat in Floresti, Prahova, and many more), festivals which give back to the communities (Electric Castle support Bontinda, Cluj community by creating job opportunities, boosting de local economy and developing the village infrastructure; other examples are Holzstock Festival, in Hosman Sibiu, Maid-en's Festival, Mountain Hen, Apuseni, Sambra Oilor, Shepherd's Festival, Mount Jina).

**Literature review**

Rural tourism is an activity that has been practiced for many years in Romania [25] and has gone through many stages, starting from an unorganized structure born from the need of people to find accommodation for their holidays, with a higher degree of comfort than camping, up to the organization of specific accommodation spaces, approved and classified according to several criteria. Rural tourism and agritourism have been significantly developed in recent years in Romania and are approaching the European standards of this field. As a result of the organization of rural tourism, there have also

appeared organizations responsible for representing their interests [30, 42], legislative regulations to support those who want to host tourists, and progress on beneficial competition that has led to the modernization and improvement of tourism activities. The concepts of rural tourism and agritourism, even if they are considered synonymous and have certain common identification elements, are different, with agritourism being included in rural tourism [52]. In principle, agritourism must comply with a series of strict criteria such as the accommodation must be in a peasant household, products obtained by the family will be consumed mainly and the tourists will be involved as much as possible in household activities. This is reflected in the specialist literature, where terms like "agritourism" and "rural tourism" are used interchangeably [48, 44]. Agritourism is not the same as rural tourism, it must be made very clear. Instead, it is a more specific subset of rural tourism.

Agritourism appeared as a solution to increase the income of rural households, by capitalizing on their economic potential, the main activity remaining agriculture. The services offered to tourists are very diverse and can cover many needs such as therapeutic treatments, rest, leisure, satisfying some passions, initiation into traditional crafts, and others. It takes different forms de-pending on the natural conditions, the stage of tourism development, and other aspects [30, 42]. Preservation of traditions and local identity are an important pillar in development, compared to the presentation of the current situation of local tourism, funding sources and initiatives of administrative bodies at national and EU level (for example LEADER). The LEADER program is known as one of the European Union’s financing instruments with the focus on the development of rural communities. It was introduced in Romania back in 2007. In the last program, 2014-2021, CAP invested nearly 20 billion in Romania's farming sector and rural areas. At EU level it was defined that the focus is on modernization, jobs, sustainability innovation and quality. Meanwhile, Romania has flexibility to adapt both direct payments and rural development programmes to its specific needs. Modernization of non-agricultural activities is covered under Sub measure 6.4. The growth of already-existing non-agricultural businesses as well as the stimulation of the rural business environment are its main goals. This will enhance the amount of non-agricultural operations carried out in rural areas, creating jobs, increasing the incomes of the rural population, and reducing the disparities between rural and urban areas.

The value of the Non-refundable support will be a maximum of 90% of the total cost of the project will not exceed 200,000 Euros/beneficiary over 3 fiscal years.

The main goal of this review article is to evaluate the agritourism situation in Romania. The research would review and analyze the articles based on the following keywords: rural development in Romania, agritourism in Romania, and landscape integration. Research outcomes will create a synthesis of the current information from the main databases (Scopus, Science Direct, Web of Sciences), and will identify the direction and the elements for improving the sector of rural development. Based on the research the identified gaps in the literature are related to the cost of restauration the old houses and using them as accommodation for the tourists, how you can analyze the rural areas and create harmony between humans, environment and developing the community, in the same time how we protect the environment, the importance of the short-chain for the products and using traditional products, how we educate the perception of the villager about agritourism.

The research team tried to approach agritourism from different perspectives, there was a focus on identifying the article related with rural development, agritourism, traditional products and landscape integration. The purpose of this was to understand the approach and if there is a need to fill a gap. Based on the database of 510 article the team created the following objectives:

**Objective 1: Analysis of the actual situation of agritourism in Romania**

Objective 1: Analyses of Romania's current agritourism status. The objective responses reveal the state of agritourism in Romania

now from the standpoint of rural development. This objective will help to provide a comprehensive view of the state of agritourism in Romania today from the standpoint of rural development.

There are many discussions and directions depending on the area of research of each of the professionals involved in the well-being of the rural area. Finally, it will offer a macro perspective on the economical, tourism and businesses based on agritourism.

**Objective 2: Analysis of international articles related to the landscape integration of the built environment.**

The objective is aiming to find out how to design accommodation structures to blend in perfectly with the surrounding landscape. Following this objective, there will be observed the state of art of the re-integration. It will be focus mainly on starting from the fact that the landscape integration (from construction to the community and environment) is not studied in Romania and there is no methodology or information regarding the way you should build/restore the accommodation structure and the cultural landscape.

The structure of the cultural landscape reflects the successive systems of beliefs, customs, and norms regarding the social, spatial, and constructive organization of communities, as well as their movements in the territory. The cultural landscape represents a territory established based on prior research that contains elements of value from the natural and cultural point of view, research included in the territorial and local landscape plans. Other landscapes that include areas that are expressions of the historical, cultural, natural, morphological, and aesthetic values of the territory and that are not currently covered from a legal point of view.

In this sense, cultural landscapes include built or unbuilt buildings whose aesthetic value is remarkable; agricultural lands that bear witness to traditional practices; groups of buildings, urban or rural with homogeneous characteristics, whose historical, urban, typological, social or traditional value justifies protection, including urban or rural residential centers; parks, gardens, agricultural fields including mansions and exploitation areas that are not classified as historical monuments, but whose value justifies protection; valuable views and viewpoints, including urban promenades, cliffs, scenic routes; areas that are characterized by the presence of a series of specific cultural elements that confer local identity (borders, roads, historic roads, infrastructures, and traditional exploitation systems or with historical value); and so on. However, there are certain normative acts regarding territorial planning and urban planning, but no specific legislation has been adopted for the identification, evaluation, and management of landscapes or a guide that integrates these elements, even if by law the European Landscape Convention was ratified.

**Objective 3: Analysis of Romanian articles regarding the traditional products in the context of agritourism**

This objective is designed to find out if food festivals a method to promote and develop traditional products, and, also, how are these concepts translated into costs. The objective will achieve information on the relation between culture and alimentation. It will, consequently, deal with the representation of traditional products in agritourism concept.

Agritourism is such a complex concept which still offers many opportunities and ways of developing communities, there are already articles which study the importance of the traditional products and dishes as a more fulfilling experience. During the past years there have been many projects related to food festivals, which creates extra activities for the tourists. There is even a discussion about a new niche of agritourism, gastronomic tourism. Even if there are still some challenges, for example the market, the lack of trust between the stakeholders, the infrastructure, this can be solved.

This study is preceded by Section 2, in which are presented the methodological aspects that guided the process of this review. Section 3 describes the main results, and the final section presents the conclusions and the recommendations for further research.

## MATERIALS AND METHODS

The methodology used in this study is a systematic literature review consisting of four steps according to PRISMA guidelines. PRISMA, is a series of modest articles reporting evidence-based comprehensive studies and meta-analyses. PRISMA is a reporting mechanism for randomized trials and reviews. It also acts as the foundation for a thorough review. PRISMA focuses on the best practices that writers can follow to produce thorough and open reports of systematic reviews and meta-analyses. Theconduct of systematic reviews with varying requirements has not been directly and extensively discussed. Preparing a systematic review according to the PRISMA methodology is the best approach, as both the reviewer and the reader of the article can go through the path that the authors have followed in order to accomplish the whole process from the be-ginning of the research until reaching the results. This study was divided into four methodological stages.

**Stage 1:** Document Collection – This is the first step where the literature is collected from various sources and analyzed based on the exclusion and inclusion criteria set for the final review.

**Stage 2:** Category Selection – The second step is to group the results into different categories based on existing trends.

**Stage 3 and 4:** Material Review - The final step is to review the material to identify key issues, insights, opportunities, and data interpretations. The databases used in the first stage of the methodology (document collection) are: Web of Science, Science Direct, Scopus. The search process was performed using keywords such as: "Agritourism" or "Rural development" or "Rural landscape integration" and the search area was restricted to articles referring to Romania. These unique phrases ought to have been located within side the title, panel abstract, and key-word section. Articles needed to offer empirical facts and/or evaluation to be taken into consideration. The search process was limited to English studies. Inclusion and exclusion criteria for the selection of primary databases for literature searches are shown in Figure 2.

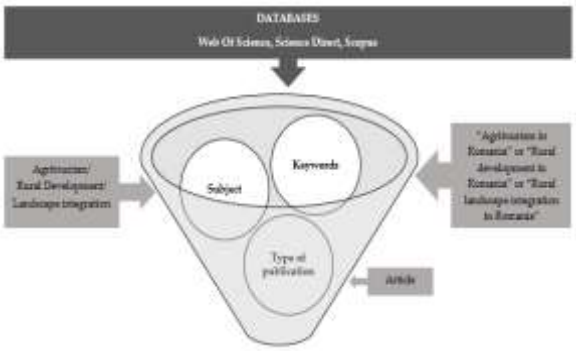


Fig. 2. Inclusion and exclusion criteria for selecting the literature review.
Source: Original figure, based on data analysis.

The primary database consisted of about 510 articles collected from the three search engines mentioned above.

The PRISMA guidelines consist of a four-step flow chart that describes the identification, screening, admission, and inclusion criteria for materials to be tested. Records were collected from the database (Web of Science, Scopus and Science Direct) followed by the next step which imply to remove duplicates.

The screening process started by excluding records based on the title element, then selected material according to the abstract, and finally excluded records after reading the full text.

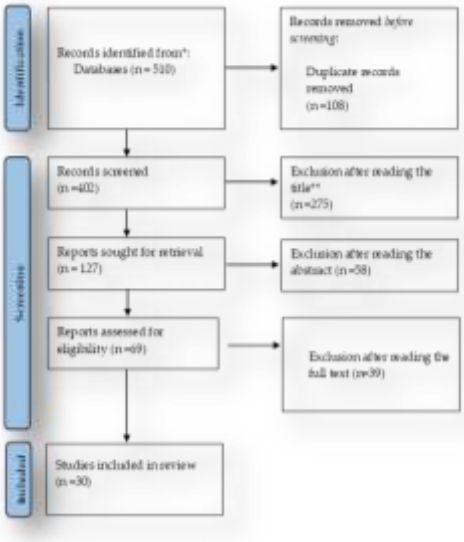


Fig. 3. The selection procedure was aided using the PRISMA flow chart as a tool.
Source: Original figure, based on data analysis.

The complete selection process is presented step by step in:

* The total number of records identified across all databases was reported (rather than reported separately each database searched)

** The records were excluded by humans, there were no automation tools involved in the process.

A number of 108 duplicates were removed in the first process of selection. Secondly, the articles were excluded after the title component (275 articles)- as mentioned in the first part of the methodology the area of interest remained Romania.

The next step was to eliminate the articles after reading the abstract- articles that had a multi topic approach were not included in the study (58 articles).

In the final step the reason for exclusion was after reading the full text-the articles with non-concluding results for this research were not taken into consideration and considered suitable to be mentioned in the study (30 articles).

## RESULTS AND DISCUSSIONS

**As stages 3 and 4 Material review,** Table 1 provides a brief presentation of the final studies included in the review (the selection process was previously described in Figure 2). An extended version of the table can be found in the appendix.

Conducting the research after the following keywords "Agritourism in Romania", "Rural development in Romania" and "Integration of the rural landscape in Romania", a database of 510 papers was created. Through the Prisma guidelines (Figure 3) the papers were sorted based on the four Prisma steps: identification, screening, admission, and inclusion criteria for test materials. This resulted in 30 works that were highlighted in the Table 1.

Starting from **Objective 1** where "The actual situation of agritourism in Romania" was analyzed, and the results were exemplified as followed:

Table 1**.** Analysis of studies which reviewed the academic literature review on Environmental and Agrifood Cultural Tradition Preservation as Part Of Rural Tourism

| **Authors** | **Title** | **Main Idea** | **Methodology/ Sample Size** |
|---|---|---|---|
| Montero-Parejo, M.J , Garcia-Moruno, L , Hernandez-Blanco, J. , Garrido-Velarde, J. (2022) [35] | Visual Impact Assessment in Rural Areas: The Role of Vegetation Screening in the Sustainable Integration of Isolated Buildings | Building integration significantly improves vegetation shielding by over 40% and visual integration ratings. | All of this was supported by statistical analysis, ANOVA test and post hoc analysis (Bonferroni test). |
| Saghin, D, Lazarescu, LM, Diacon, LD, Grosu, M. (2022) [49] | Residents' Perceptions of Tourism: A Decisive Variable in Stimulating Entrepreneurial Intentions and Activities in Tourism in the Mountainous Rural Area of the North-East Region of Romania | The close relationship between the public's positive perception of rural tourism and the launch of numerous businesses in the tourism sector has been explored. | The research is conducted through a statistical analysis addressed to residents of 78 municipalities in the mentioned area. |
| Chiciudean, DI, Harun, R, Muresan, IC, Arion, FH, Chiciudean, GO. (2021) [6] | Rural Community-Perceived Benefits of a Music Festival | This article is highlighted by analyzing not only the perceptions of tourists who attend these festivals, but also the perceptions of the music festivals of the Romanian rural communities that organize them. | The tools used to conduct this study were questionnaires designed to measure festival cultural benefits and costs, as well as community well-being. The empirical study is based on a database of 136 responses. |
| Ciupe, I.A. (2021) [9] | Spatial patterns of second home development as part of rural landscapes. A case study of Apuseni nature park | This study's objectives are to identify the spatial patterns of second homes in connection to significant local environmental characteristics and to offer stakeholders in second home tourist integration planning with a useful foundation. | This study's methodology was built on earlier methods for multivariate categorization landscape analysis, with the addition of a tourist component. |
| Cozma, A.C , | Mountain Tourism in | The author tries to | The study relied on quantitative |

| | | | |
|---|---|---|---|
| Coros, M.M , Pop, C. (2021) [11] | the Perception of Romanian Tourists: A Case Study of the Rodna Mountains National Park | understand why tourists are interested in visiting nature and national parks, find out the causes of dissatisfaction and the solutions tourists have to remedy the identified problems. | methods and they used tourist surveys on social media platforms and online forums and distributed them to national park visitors with the help of ARMNP. |
| Dumitras, D. E , Mihai, V.C , Jitea, I.M , Donici, D , Muresan, I.C (2021) [13] | Adventure Tourism: Insight from Experienced Visitors of Romanian National and Natural Parks | Although the focus of the study is adventure travel, other aspects such as accommodation and dining are also seen as key aspects that need improvement. | Researchers conducted an online survey to understand the culture of adventure tourism. They used descriptive statistics and independent t-tests to determine differences between groups. |
| Epuran, G , Tescasiu, B, Tecau, AS, Ivasciuc, IS, Candrea, AN. (2021) [14] | Permaculture and Downshifting -Sources of Sustainable Tourism Development in Rural Areas | The researched area consists of the mountainous areas of Brasov county. | The survey included 383 agrotourism guesthouses and 236 traditional guesthouses and traditional restaurants. Of these, 5 agritourism guesthouses and 3 restaurants were selected for detailed analysis, and 5 samples were drawn from 345 guides. |
| Herman, GV , Banto, N , Ciaciora, T , Ungureanu, M , Furdui, S , Garai, LD , Grama, V (2021) [24] | The Perception of Bihor Mountain Tourist Destination, Romania | This study aims to present tourists' perceptions of the mountains of Bihor and to highlight the need for a quality-price ratio in accommodation and catering structures. | Researchers have used questionnaires as a way to analyze tourists' perceptions of the Bihor area. 135 respondents participated in the survey. |
| Muresan, IC, Harun, R, Arion, FH , Fatah, AO, Dumitras, DE. (2021) [38] | Exploring Residents' Perceptions of the Socio-Cultural Benefits of Tourism Development in the Mountain Area | This study describes a survey conducted in June 2018 in a mountain village in Cluj County, Romania. | The research method used in this article is a survey. Forty-eight questionnaires were validated, their results were validated by statistical description, and the varimax rotation method was used to reduce the variables to a smaller set. |
| Popescu, G, Popescu, CA, Iancu, T, Brad, I, Pet, E, Adamov, T, Ciolac, R. (2021) [46] | Sustainability through Rural Tourism in Moieciu Area-Development Analysis and Future Proposals | One of the purposes of this work is to promote the special mountain area around Bran Castle under the name "Moeciu Brand". | Using a questionnaire technique, the survey analyzed the responses of 858 tourists which were accommodated in the area. |
| Scutariu, AL, Scutariu, P. (2021) [50] | Perceptions of the local government and the residents regarding rural tourism development effects. Survey in the Suceava County - Romania | The purpose of this study was to determine the impact of tourism development on administrative systems, living standards and the environment by presenting the perspectives of local government agencies and local citizens' human resources in Suceava County, Romania. | A survey-based study revealed that the level of tourism development had a positive impact on the level of improvement in public relations management processes within relevant administrative districts and on the quality of life of the local population. |
| Adamov, T., Ciolac, R., Iancu, T., (...), Popescu, G., Șmuleac, L.(2020) [1] | Sustainability of agritourism activity. Initiatives and challenges in Romanian mountain rural regions | The aim was to determine the current state of agritourism activity in the three regions and develop proposals that closely address the specific needs of the regions. | The study was conducted in a rural area of Romania, an area with high potential for agritourism. A questionnaire was used and some suggestions were made based on the conclusions drawn. |
| Galluzzo, N (2020) [18] | The evolution of Romanian agritourism and the role of European Union subsidies in rural areas | The growth of agrotourism is directly correlated with the number of immigrants from Romania and indirectly with the Gross Domestic Product. | The authors used data from the Romanian Statistical Institute and the Agricultural Accounting Data Network. Additionally, the XLSTAT software was used to establish the relationship between financial grants and other payments from his CAP under the first and second pillars. |

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| Gica, O.A., Coros, M.M., Moisescu, O.I., Yallop, A.C. (2020) [21] | Transformative rural tourism strategies as tools for sustainable development in Transylvania, Romania: a case study of Sâncraiu | This article explores how traditions support the growth of sustainable tourism as well as the creation and marketing of new travel goods based on distinctive local heritage. | Using a methodological case study approach, this white paper presents an example of a sustainable rural tourism destination from a developing region in northwestern Romania (Cluj County, Transylvani). |
| Montero-Parejo, M.J , Moruno, L.G , Rodriguez, A.M.R , Blanco, J.H , Velarde, J.G. (2020) [36] | Analysis of Facade Color and Cost to Improve Visual Integration of Buildings in the Rural Environment | So much for public taste, but when it comes to cost, regardless of typology, painting accommodations in the right color is always greatly appreciated, even though it is 15% more expensive than white. Analysis shows that it is high. | The researchers created infographics, conducted a small pilot study, and after identifying the limited impact of social variables on outcomes, increased the number of participants from 40 to 120. |
| Paul, L. (2020) [45] | Rural Development in Romania - A Few Considerations | s a component of the Common Agricultural Policy (CAP), rural development strategies were first introduced under Agenda 2000. CAP is a complex system of regulations that can guarantee rural dwellers a steady income and respectable standard of living. | The author From the fall of the communist rule 1990 to 2020, the author examined the development of rural Romania. |
| Muresan, IC, Harun, R, Arion, FH, Oroian, CE, Dumitras, DE, Mihai, VC, Ilea, M, Chiciudean, DI, Gliga, ID, Chiciudean, GO. (2019) [39] | Residents' Perception of Destination Quality: Key Factors for Sustainable Rural Development | This study is important for determining the main development directions that local governments should consider for inclusion in their local development plans. | The survey was conducted on the basis of 433 questionnaires with valid responses applied in Northwestern Romania. Statistical data processing methods include ANOVA and QUALITEST |
| Ibanescu, BC; Stoleriu, OM; Munteanu, A; Iatu, C. (2018) [26] | The Impact of Tourism on Sustainable Development of Rural Areas: Evidence from Romania | The purpose of this study was to conduct a comparative analysis of three metrics: demographics , utilities, socio-economic development. | The method used in this study was the Mann–Whitney U test. |
| Nicula, V , Popsa, RE. (2018) [41] | Involvement of Rural Tourism Operators in the Project "Sibiu European Gastronomic Region | This study introduces the concept of gastronomic tourism as a new niche in rural tourism. | Statistical data were collected with a questionnaire that includes quantitative and qualitative information collected from 160 tourists. |
| Martino, Simone Muenzel Dominic (2018) [34] | The economic value of high nature value farming and the importance of the Common Agricultural Policy in sustaining income: The case study of the Natura 2000 Zarandul de Est (Romania) | Its purpose is to provide decision support related to high natural value agriculture and to discuss the contribution of public subsidies and agri-environmental planning to farmers' income. | This study applies a recently developed toolkit TESSA which provides a set of charts to help practitioners assess five major terrestrial ecosystem services: carbon sequestration, recreational value, crops, and products and services associated with bare forests. present. |
| Ciolac, R , Rujescu, C , Constantinescu, S , Adamov, T , Dragoi, MC , Lile, R (2017) [8] | Management of a Tourist Village Establishment in Mountainous Area through Analysis of Costs and Incomes | This paper aims to describe tourist villages from three main aspects: Characteristics, stages of development and their advantages. | After amassing the data, researchers used mathematical calculations to apprehend the feasibility of the project. |
| Coroș, M.M., Gică, O.A., Yallop, A.C., Moisescu, O.I. (2017) [10] | Innovative and sustainable tourism strategies: A viable alternative for Romania's economic development | The purpose of this paper is to examine how the development and promotion of new tourism products based on unique rural heritage and traditions contribution of developing of sustainable tourism | A methodological case study approach was used, this paper presents an example of a sustainable tourism destination in Romania's Central Development Region (Alba County, Transylvania). |

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| | | strategies. | |
| Dragoi, M.C , Iamandi, I.E , Munteanu, S.M , Ciobanu, R , Tartavulea, R.I , Ladaru, R.G (2017) [12] | Incentives for Developing Resilient Agritourism Entrepreneurship in Rural Communities in Romania in a European Context | This study analyzes agritourism in terms of economic, social and tourism factors that influence the development of agritourism business. | The sample contains information from the Romanian National Institute of Statistics for the period 2010-2015. It used ordinary least-squares regression to test how economic, social and tourism affect Romanian agribusiness. |
| Tieskens, K.F.C., Schulp, J.E., Levers, C., Lieskovský, J., Kuemmerle, T., Plieninger, T., Verburg, P.H., (2017) [53] | Characterizing European cultural landscapes: Accounting for structure, management intensity and value of agricultural and forest landscapes | This paper presents characteristics of the European cultural landscape based on the distribution of three key aspects of the cultural landscape: Landscape structure, management strength and value and importance. | For this analysis, the current version of CORINE Land Coverage was used to assign data to different land cover classes (EAA, 2012). |
| Liang, T.C , Peng, S.H (2017) [32] | Using Analytic Hierarchy Process to Examine the Success Factors of Autonomous Landscape Development in Rural Communities | AHP is a practical solution aimed at dividing complex, unstructured problems into groups and organizing them into hierarchies | Based on a literature review and discussion with experts resulted in an Analytic Hierarchy Process which consists of six processes: Identification of evaluation factors, construction of hierarchical structure, establishment of dual matrix, solution of eigenvalues and eigenvectors, consistency check of dual matrix, solution of dominant factor part. |
| Jordan, P., Havadi-Nagy, K.X., Maroşi, Z. (2016) [28] | Tourism as a driving force in rural development: Comparative case study of Romanian and Austrian villages | This article presents comparative results on the role of tourism in rural development, especially through tourism, | The paper compared 6 case studies (3 Romanian ones along with 3 Austrian study cases. |
| | | between Romanian and Austrian rural development practices. | |
| Muresan, IC, Oroian, CF, Harun, R, Arion, FH, Porutiu, A, Chiciudean, GO, Todea, A, Lile, R. (2016) [40] | Local Residents' Attitude toward Sustainable Rural Tourism Development | Research on factors influencing rural tourism relates to residents' perceptions of the benefits of living in tourist destinations. | Data obtained from official statistical and quantitative surveys were processed using statistical methods and split into several variables to achieve the purpose of the work. |
| Rahoveanu, M.M.T., Soare, I., Zugravu, A., Rahoveanu, A.T., Şorcaru, I. (2016) [47] | Traditional food technologies opportunity to increase the competitiveness of agriculture | The purpose of this study was to highlight the relationship between traditional Romanian products and the development of agritourism. | Descriptive statistics were used to describe the geographical distribution of traditional Romanian products, grouped into numbers and categories. |
| Gavrilă-Paven Ionela, Bârsan Mircea Constantin, Lia-Dorica Dogaru.(2015) [19] | Advantages and Limits for Tourism Development in Rural Area (Case Study Ampoi and Mureş Valleys) | This article explores the benefits and drawbacks of promoting tourist initiatives through a leader approach at the level of local action groups in Romania's Hunedoara County. | The Ampoi Valley and Murew Valley Sustainable Rural Development Plan has tourism development as one of its goals. |
| Beciu, S., Oana, P., Nistor, S., &Olteanu, V., (2011)[4] | The socio-economic dimension of rural development for the North-East region of Romania | The purpose of this paper is to deal with the social and economic aspects of rural development, identify the main problems and prospects of the region, and implement and improve appropriate solutions of regional development strategies. | To highlight the genuine scope and prospects of sustainable development in the area, a SWOT analysis was employed as the approach. |

Source: [35, 49, 6, 9, 11, 13, 14, 24, 38, 46, 50, 1, 18, 21, 36, 45, 39, 26, 41, 34, 8, 10, 12, 53,32, 28, 40, 47, 19, 4].

-The research team discovered that most of the researcher's approach was to identify the perception of the tourist destination in rural areas. How those have an impact on the living standards, administrative systems, the time evolution of agritourism, and the possibility to improve or the direction to develop a specific region. There are no results or papers approaching the cost and benefits of blending the accommodation structures into the cultural landscape.

-The focus at this point is on the economic profits, it is understandable that it is one of the most important aspects when someone starts a business. But in long term without taking into consideration the community, the cultural heritage the environment there will be no sustainable development or specificity, will no matter if you visit an accommodation area from the mountains or from the seaside if the food is specific to the Danube or to the ethnical community of the Hungarians.

-A further important aspect of the agritourism is represented by the integration in the concept of traditional products as part of cultural heritage. In order to receive better national and, international recognition these traditional products and practices must be preserved. The best way to achieve this goal is to bring up to the farmers and producers the concept of food quality schemes. As an alternative to the European Union certification schemes, in Romania were developed national certification schemes. The aims of these national certification schemes are similar to those elaborated by the European Union such as: to preserve traditional recipes and practices, to contribute at the growth of local economy by engaging in the process the whole production chain. We would like to mention that these types of national certification schemes can be initiated by non-governmental entities such as AgroTransilvania Cluster. To sustain this initiative the Cluster has proposed a national certification scheme entitled "Reteta Consacrata".

This certification ensures customers that the Product or composition, method of production is established by use of a recipe whose use has been demonstrated on the market for a sufficient amount of time to allow transmission between generations, this period cannot be less than 30 years. The scheme involves compliance with mandatory product specifications, this being verified by public authorities or an independent examination body which guarantees complete product traceability and in terms of transparency is available to the general public. Agritourism must be seen as a complete cycle that incorporates aspect of rural landscapes, agricultural practices and traditional recipes.

Another example of the importance of blending is the vegetation used and how will impact the environment, the tourist has to possibility to discover plants such as *Iris ruthenica, Dianthus callizonus, Rhododenderon kotschyi* in the Carpathian Mountains but some entrepreneurs decide to use them for their accommodation structures plants as *Rey-noutria japonica, Impatiens glandulifera, Erigeron annuus* (formerly *Aster annuus*) which are invasive species and will affect the ecosystem. It is important to know the differences between building conventional or with local materials, and how long will take to cover the cost and obtain profit.

The **Objective 2** focused on finding how to design accommodation structures to blend in perfectly with the surrounding landscape. By analyzing the articles, it is observed that it could not be identified a unitary methodology. In conclusion, it is a gap in this direction and as an answer, the research team launches the challenge for the next research papers to try to propose how to integrate the accommodation structures in the cultural landscape (economical, cultural, environmental, community).

According to **Objective 3** in which the Romanian articles regarding traditional products in the context of agritourism were studied, the findings were outlined as below: based on the articles that the researchers studied they reached the conclusion that food festivals are a good example of how to promote and sustain traditional products. Traditional food has always played a major role in agritourism area, and by supporting the promotion and purchasing process of traditional products through events, this might

bring important incomes for rural areas. Beside this as a good side effect there are opportunities for developing accommodation structure and infrastructure which is a big win for the community, it is also important to take into consideration how to improve and conserve the cultural landscape and environment which usually suffers during those events.

In order to respond to the last objective of this research paper, the research also rises the conclusion that, at the moment, there are studies that are presenting the cost and the income of a tourist village, it is important to have this information for other types of accommodation structures and guides with the purpose of educating the community on the way they could do the agri-business in rural areas, more inclusive and sustainable for all the aspects that constitute the rural areas.

## CONCLUSIONS

Agritourism along with the other fields are part of the legislative umbrella of the European Union and any regulation adopted applies to agritourism too. One of the most recent legislations is the Green Deal, a set of policy measures that attempts to move the EU toward a greener path. This program targets several sectors, so it is critical to stay informed and keep up with the developments. In this study, we want to emphasize that Romanian agritourism has a lot of possible methods and may be a good fit with the legal framework of the European Union. As part of Green Deal, the Farm to fork strategy could be implemented through Agritourism and traditional practices. The main role of this strategy is to shift the cur-rent food system into a sustainable model and to offer the consumers a traceability of the raw materials/ products through the whole value chain. But apart from this role, Farm to fork could be translated into a national certification scheme such as the one proposed by AgroTransilvania Cluster - “FermOras” which means from farm to city. The main objective of this initiative is to reduce the CO2 emissions by shortening the distance between the supply chain and to encourage consumers to buy local and authentic products by providing the city inhabitants with products/ raw materials that are being produce in the proximity of the city (this way shortens the distances between consumers and producers)

Another part of Green Deal is the EU chemicals strategy for sustainability which has the purpose to support a toxic-free environment and to militate for a better protection of the human health. Preserving the traditional methods of production could lead to a de-creased use of chemicals/ food additives when it comes to food products. The same way goes for the land use, for example an Agritourism unit could use natural fertilizers to produce their own vegetables harvest.

The present paper followed to understand and to create a synthesis of the actual in-formation related to agritourism which focus on rural development, landscape integration and traditional products. Agritourism plays an important role in the communities, being the second source of income, and besides this there are many benefits resulting from it such as, creating employment opportunities, contributing to development of the community, preserving the cultural landscape (traditions, architecture, products, specific plants, and animals). Agritourism has reduced impact on environment, and it is a sustainable option to mitigate the negative impacts of climate change.

Firstly, this research presents the concerns about the approach of the investors, the need of building touristic villages when there are so many traditional houses which can be reused as accommodation structures with an investment. Which is directing for the first recommendation of studying the cost between the restauration of an old house and building a new one (according to the specificity of the area). Most Romanians live in rural areas, so they do not understand who is interested in this type of tourism. On the other hand, there are tourists interested in adventure tourism who will appreciate having some facilities, as well as foreign tourists. As a result, it is important to understand the needs of the tourist and to create a customer profile. On the other hand, the publications that discuss the

effects of agritourism in rural regions and the means of development are significant because they provide knowledge or serve as examples of good practices. Furthermore, along the second Objective 2, it is referred that there is not a single article related to the integration of structure in the cultural landscape, how the materials can affect the environment and the aspect of the village, the way you can be more sustainable and connected with the needs of the community. There have been identified 3 articles (31, 45, 54), as an example of good practices, which present the impact of the facade and vegetation on the human mind and are the cost of this and the other article propose a methodology of analyzing and creating solutions for the landscape. At this moment the landscape architects and engineers are using different methods of under-standing the rural area, but there is a need for a general plan for developing relevant actions and sustainable solutions for rural areas, agritourism and in the end for the accommodation structure. However, the landscape analysis should be mandatory before doing any type of construction and besides there is a need of presenting the traditional architecture in mod-ern days and it should be considered in the financial plan. The main objectives of land-scape protection are to save, preserve and integrate nation-al/regional/local identity values as an essential element of sustainable development. This concept still exists in different forms, in principle imprecise in several normative acts, but it is for the first time that a unitary vision of the landscape is defined, Romania being among the first states to ratify the European Landscape Convention from Florence, through the law mentioned above.

Moreover, it was presented 2 articles related.

to traditional food, gastronomic tourism is a niche which can exploit and support agritourism to another level and there is still a lot to explore about this domain. For the moment, there are only 8 traditional products protected and recognized in the EU. It should be studied the reasons and the solution for this, as well for developing the short-chain practice.

In some of the articles it was mentioned that the cost of developing an accommodation structure, and this is a good way of supporting the entrepreneurs and maybe will help fully understand if or form where they can access financial support. However, there was analysis which proves that the harmony of the accommodation is a criterion of selections, and more people are eager to pay to make sure that they offer a better future to their children.

This research paper concludes that there are numerous factors that should be taken into account, and it is crucial to work in multidisciplinary teams to find a complex solution in order to develop businesses, create jobs, maintain the community, protect the environment, and prudently exploit the resources. The world is a diverse place and has the right and obligation to learn and protect the diversity of it.

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Development Fund "Investing for your future", Section B—Competition code POC-A1-A1.1.1-B-2015—Project type—Innovation clusters. P_35_476, co-funded by European Regional Development Fund).

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# FISHERIES AND AQUACULTURE IN ROMANIA. A GLOBAL OUTLOOK ON SUSTAINABLE DEVELOPMENT

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***Abstract***

*The paper proposes an analysis of the fishing sector in Romania, from the perspective of the exploitation of natural resources. Romania's hydrographic network represents over 3.5% of the country's total area. Fishing and aquaculture are activities carried out in all regions of the country. In the areas along the rivers and the Black Sea, fishing is the primary source of income for the population of the region. In the last decades, fish production from aquaculture has regularly exceeded the catch. Romania's foreign trade with fish and aquatic products has an unbalanced balance, with a significant dependence of the domestic market on imports. The average annual fish consumption per capita in Romania is below the European average, although a positive evolution has been recorded in the recent period. The implementation of European projects by the companies operating in the Romanian fishing sector is difficult, the degree of access to the funds available to the domestic sector being characterized by a relatively low level of absorption. The lack of effective measures from the public authorities to support the national fishing sector will accentuate its decline, and the domestic market's dependence on imports from abroad will continue to grow. The research results can be useful to companies in the fishing sector, for accessing European funds, and to public authorities, in developing appropriate public policies and strategies.*

***Key words*****:** *fish market, Romania, fish farms, aquaculture, strategies*

## INTRODUCTION

Aquatic products represent a category of food present in human nutrition since ancient times.

Their chemical composition, characterised by components valuable for human metabolism, their availability for sustainable consumption, their relatively affordable price or their perception as healthy foods have led to a growing demand worldwide.

In the 21st century aquaculture and fisheries sectors are recognized as key points for the global food security. Fishery products are considered some of the most active global foods in terms of production and trade, taking into account the development of fisheries and aquaculture, characterised by significant growth in recent decades. The only source of essential fatty acids - omega 3, which are not produced by the human body, but are absolutely necessary, is represented by fish and fish products.

Fish is not only an important food resource in a balanced human nutrition, but the activities related to catching fish, their preparation and consumption are traditional practices in many regions of the world, which are part of population's cultural heritage.

***Short literature review***

Farms intended for growing fish and crustaceans, respectively the cultivation of aquatic plants are part of the aquaculture sector or, more generally, the field of fish farming. Aquaculture is one of the most productive food production sectors, responsible for approximately 50% of the world's consumption of fishery products. The production of the aquaculture sector has evolved rapidly over the past 30 years, with an average annual growth rate of 8.8%. (Food and Agriculture Organization of the United Nations FAO, 2020) [8].

FAO also stated that aquaculture is currently the fastest growing and most consistently growing food production sector. The global catch from sea and inland fisheries has registered a relatively stable level in recent years, with quantities fluctuating around 90 million tonnes. To meet the global demand for

aquaculture products, aquaculture production has exhibited continuous growth (Muntenu (Pila) and Stanciu, 2018) [12]. Thus, the world production of fish in 2017 was 172.7 million tons. More than half of the global production (92.5 million tons, representing about 53.6%) was obtained from fisheries, and 80.2 million tons (46.4%) from aquaculture (FAO, 2020) [8].

The FAO forecast predicts that starting with 2030, the production of aquaculture intended for human consumption will quantitatively exceed the volume of catches (Aquaculture Magazine, 2022) [1]. In 2020, according to the latest FAO statistics report on aquatic production, about 178 million tons of aquatic animals were recorded, in a slight decrease compared to the previous production, in the context of the COVID 19 pandemic, and about 36 million tons of algae, increasing by 1.4% compared to the previous year. As a share in global fish production, catches represented 50.57%, the rest being contributed by aquaculture (FAO, 2022) [9].

In the European states bordering marine areas fish consumption is high, this food constituting an important component of the Mediterranean diet. There are many health benefits associated with the consumption of fish and aquaculture products, such as positive effects due to the amino acids present in proteins on blood pressure and lipid profile, the existence of valuable mineral components (iodine, calcium, iron, zinc, selenium or phosphorus), or of vitamins important for human metabolism (A, D and K). The most studied components of fatty fish meat are polyunsaturated fatty acids (mainly n-3 fatty acids including eicosapentaenoic acid EPA and docosahexaenoic acid DHA), with beneficial effects on cardiovascular health, lipid profile, inflammation, insulin resistance, neurocognitive disorders or cancer. Despite pointing out some potential risks associated with fish consumption, they are far outweighed by the benefits, as noted by de Molina-Vega, Gomez-Perez and Tinahones (2020) [11].

A regular consumption of fish can have beneficial impacts on homeostasis, facilitates maintenance of a healthy body weight, reduces the magnitude of age-associated increases in blood pressure, improves glucose homeostasis helping prevent diabetes and the metabolic syndrome, and has a positive impact on muscle mass preservation among the elderly (Mendivil, 2021) [10].

The afferent study among the population of Croatia, carried out by Pupavac and all (2022) [15] highlighted that age, level of education and an orientation towards the Mediterranean diet, even a moderate one, are factors with a significant effect on the recommended consumption of fish. The Mediterranean diet is considered a model for a healthy life, based on a sustainable diet (Burlingame and Dernini, 2012; Portugal-Nunes et al., 2021) [5, 14] with numerous economic, social and cultural benefits. There are differences between the quality of caught fish and aquaculture fish consumed by the population, because the chemical composition of fish meat depends substantially on the growth node. Aquaculture-based fish consumption can have beneficial implications for the environment and improve the quantity and degree of population supply (Berry, 2019) [2].

According to the conclusions formulated by the World Economic Forum (2022) [17] the highest level of annual fish consumption per capita is among populations in marine regions (Iceland or the Maldives, with over 80 kg), while in the countries without access to the sea (Afghanistan, Ethiopia and Tajikistan, etc.) the annual consumption is very low (below 1 kg/inhabitant). Between 1960 and 2019, the global average of fish and seafood consumption per capita doubled, reaching a value of 20.5 kg/2019, from 9.9 kg/1960.

Fish and seafood are an important source of protein globally, covering approximately 6% of the food needs of the population. For about 30% of the world's population, fish represents over 20% of the average intake of animal protein per capita.

Global food consumption patterns based on the use of aquaculture products must take into account the complex effects on consumer health and the environment, social and economic aspects. From this perspective, further research and analysis is needed on alternative protein sources (such as based on

algae), on the adverse environmental effects due to pollutants, climate change and their implications on fish stocks, ensuring a balance between aquaculture production and catches etc. (Nesheim, Oria and Yih, 2015) [13].
In this context, the main objective of the paper is an analysis of the fishing sector in Romania, from the perspective of environmental effects and a better exploitation of natural resources.

## MATERIALS AND METHODS

Google Scholar, ResearchGate, Web of Science - Clarivate Analytics were taken over for documentation. For the legislative regulations, the information from public institutions was used. Data provided by the European Commission, the European Parliament, the Government of Romania, the Ministry of Agriculture and Rural Development, the Food and Agriculture Organization of the United Nations were collected, processed and analysed. The results were compared with scientific papers from the specialized literature, to validate the conclusions.

## RESULTS AND DISCUSSIONS

### The European aquaculture production

The European Parliament Report (2022) [7] showed that between 1990 and 2017 there was a 400% increase in world aquaculture production, based on an increasing demand from the population. The total production of aquaculture seafood in Europe has been relatively constant, being valued at around 1.2 million tonnes in 2017, according to the European Union's statistical system.
According to the DG Maritime Affairs and Fisheries (European Commission EC, 2020) [4], the European strategic plan provided for an annual increase in the production of the European aquaculture sector by 3.2%, being estimated to reach a sales volume of 5, 6 billion euros (Figure 1). At the same time, the increase in the profitability of the sector will have to be correlated with measures to protect the environment and reduce CO2 emissions, with controls to reduce poaching and protect aquatic fauna, against the background of the reduction in the share of capture fishing at the level of the European Union EU (EC, 2020) [4].
The European aquaculture production covers around 20% of the European common market's fish and crustacean supply.

Fig. 1. Evolution of aquaculture in Europe
Source: Authors, by using EC (2020) [4].

The European aquaculture production sector consists of around 15,000 companies, mainly small or micro-enterprises in coastal and rural areas, employing more than 70,000 people. Increasing the proportion of women in the workforce, reducing costs and higher profitability are the main desires of the sector in the next period (EC, 2020) [4].
From a value point of view, the value of European aquaculture production has evolved constantly, reaching EUR 5.6 billion in 2022, an increase of 24% compared to the previous period (European Parliament, 2022) [7]. About 76% of the sector's production was represented by fish products, the rest by crustaceans and molluscs. Edible algae production is low in Europe, although there is considerable potential for growth.
Around 100 different aquatic species are bred in European aquaculture farms, most specialising in shellfish (45%), followed by marine fish (30%) and freshwater fish (20%). Although there is great diversity in European aquaculture production, 4 species are representative in terms of proportion: mussels, salmon, trout and oysters, covering about 71% of the total. Sea bream, carp, perch and clams are also other species raised by fish farmers. (Figure 2).

Spain (21 %), France (15 %), the United Kingdom (14 %), Italy (14 %) and Greece (10 %) are the countries with the main aquaculture producers in Europe. Approximately 74 % of total aquaculture production in 2017 is provided by these contries. The UK is the largest producer in terms of value of fish and seafood production (21%), followed by France (16%), Spain (13%) Greece (12%) and Italy (11%).

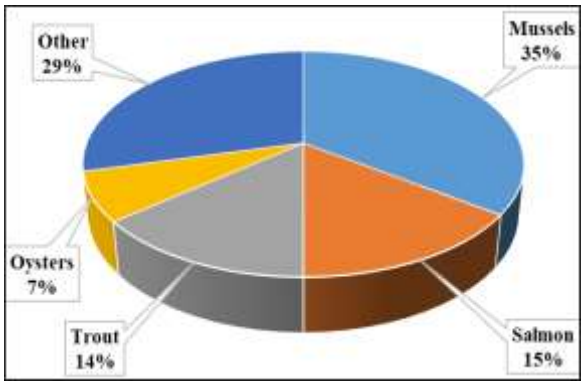


Fig. 2. EU aquaculture by species
Source: Authors, by using European Parliament (2022) [7].

Production of bivalve molluscs (mussels, oysters and clams) predominates in Spain, France and Italy, while salmon is produced in the United Kingdom and Greece supplies the European market with sea bass and sea bream (EC, 2022) [5]. The development of the aquaculture organic sector represents another important objective of the European policy in the field of maritime affairs and fisheries.

The European Market Observatory for Fisheries and Aquaculture (EuMOFA) report, cited by Aquaculture Magazine (2022) [6], estimated that at EU 27 level the total organic aquaculture production reached 74,032 tonnes in 2020 (about 6.4% of total EU aquaculture production). Between 2015 and 2020, the sector grew by 60%, mainly due to organic mussel production. Organic production has stagnated or declined slightly, due to low demand and technical difficulties in implementing organic production standards. The main species in organic aquaculture are mussels, with more than 50% of total production (41,936 tonnes), followed by salmon (12,870 tonnes), trout (4,590 tonnes), carp (3,562 tonnes), oysters (3,228 tonnes) and European seabass /gilthead seabream (2,750 tonnes). The main European organic aquaculture producers are dedicated to raising certain species: Ireland (salmon and mussels), Italy (mussels and fish), France (oysters, mussels and trout), the Netherlands (mussels), Spain (mussels and sturgeon), Germany, Denmark and Bulgaria (mussels).

**Aquaculture in Romania**

On the Black Sea coast, Romania has an exclusive economic zone (area 25,000 km$^2$ and a coastline of 250 km). About 3% of the national area of Romania is covered by the hydrographic system, with over 843,710 ha. Natural areas with potential for the fisheries sector include: 400,000 ha of natural lakes (including the Danube Delta and 7 reservoirs), 84,500 ha of fish farms, 15,000 ha of nurseries, 66,000 km of rivers, of which 18,200 km in the mountain area and 1,075 km on the Danube River (Government of Romania, 2007) [16]. In 1990-2020 the fishing sector in Romania registered an important decrease, with the reduction of production and consumption. As a result of this process, there is currently a strong dependence of the domestic market on imports.

Integration into the EU brought projects worth more than 730 million euros to the Romanian fishing sector, through the European funding programs: European Fisheries Fund (2007-2014), European Maritime and Fisheries Fund (2014-2020), and European Maritime, Fisheries and Aquaculture Fund (2021-2027), correlated to the contribution of the Romanian Government (Figure 3).

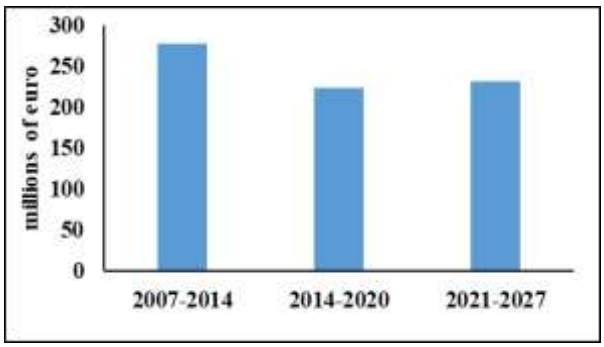


Fig. 3. Funds allocated in Romania
Source: Authors, by using EC (2023) [6].

For the current financial year, total funds in the amount of €232 million are available, of which €162.4 million are allocated in the financial period 2021-2027 through the European Maritime, Fisheries and Aquaculture Fund (EC, 2022) [6], the rest being the contribution of the Government of Romania.

The main activities targeted for financing are the sustainable development of fishing, aquaculture, processing and marketing, as well as the sustainable blue economy in coastal, island and inland regions, in line with European environmental protection policies and the reduction of climate changes (Figure 4).

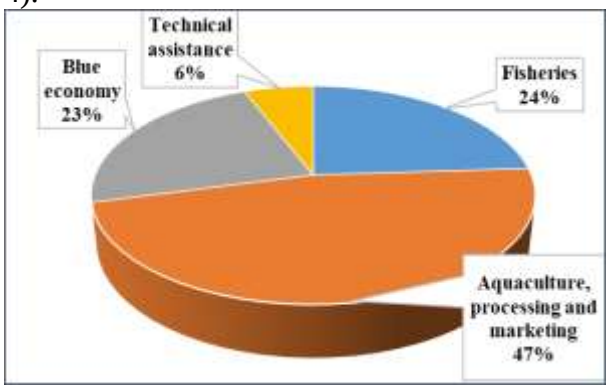


Fig. 4. European funds allocation for the Romanian Fisheries Programme 2021-2027
Source: Authors, by using EC (2022) [6].

The main objectives for European funding are investments related to compliance with the landing obligation and the modernization of fishing infrastructure; compliance with European fisheries conservation policies; increasing energy efficiency and reducing the CO2 footprint in fishing and aquaculture; the temporary cessation of conservation policy objectives and the public health crisis; encouraging small-scale coastal fishing; sustainable aquaculture projects; support for new producer organizations; compensations for environmental services; fisheries control and data collection in application of the common fisheries policy; innovation in aquaculture and fishing; a sustainable development of coastal and inland areas in the context of the blue economy, support of local action groups.

The European program is focused on the ecological transition of the sector, with investments in actions to improve the fishing infrastructure, the selectivity of the tools, the reduction of the $CO^2$ footprint and the increase of energy efficiency, the development and establishment of marine protected areas and a better collection of marine waste (EC, 2022) [6].

## CONCLUSIONS

The European funds allocated to the fishing sector did not lead to the expected effects on the domestic fishing sector. Although there are sufficient natural resources available, it is not able to use them and cover domestic demand, in the context of massive imports and competition from European producers.

The cooperation of producers in the fishing sector is still deficient. Producer organizations do not have the financial and organizational capacity to become poles of attraction for other producers in the sector and market decision-makers.

COVID-19 has highlighted the inefficiency of the local fishing sector, with many producers forced to stop production or reduce activity.

The main recommendations that we believe should be mentioned following the research are: development of entrepreneurial skills for fish farmers, more effective support measures from public institutions, actions to raise consumer awareness and promote local fish products can lead to the revitalization of the sector.

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# LIVESTOCK AND ANIMAL PRODUCTION IN ROMANIA - DYNAMICS AND STRUCTURAL CHANGES IN THE PERIOD 2007-2020

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***Abstract***

*The paper analyzed the evolution animal sector regarding livestock and production in Romania in the period 2007-2020. Two sub-periods: P1- 2007-2013 and P2 2014-2020 were compared for assessing if the achievements in P2 were superior. The data from the National Institute of statistics regarding livestock and production by species were processed using fixed basis index, structural index, regression equations, coefficient of determination, multi annual mean per decade, absolute and relative differences between P2 and P1, in order to emphasize the trends and changes during the studied period. The results emphasized the following: the number of bovines, pigs and poultry decreased, while the number of sheep and goats and bee families increased both in P2 and P1. The total animal live weight at slaughter diminished due to the lower and lower live weight of bovines and pigs. However, the increased live weight at slaughter of sheep, goats and poultry had a positive impact. Milk and egg production declined and continued in P2, while wool and honey production increased. Despite that agricultural production value in animal sector increased by +20,420 trillion Lei in 2020 versus 2007, it was by 68.61% smaller than the agricultural production value achieved in the vegetal sector. In consequence, the contribution of animal sector to agricultural output was just 31.39% in the year 2020. The gaps in domestic production have to be covered by imports to meet consumers' requirements and this will deepen the deficit in agro-food trade balance. The reduction of $CO_2$ emissions in agriculture, where 50% come from animal sector, obliges farmers to set up strategies destined to promote animal products obtained from more environment friendly technologies.*

***Key words*****:** *animal sector, livestock, production, contribution to agricultural output value, structural change, Romania*

## INTRODUCTION

Foods of animal origin have a high importance in human diet and health due to their content in valuable nutrients like proteins, fats, minerals and vitamins.
A healthy life style means a balanced diet including all the nutrients and high value proteins. That is why milk and dairy products, meat of various sorts (beef, veal, pork, mutton and lamb, poultry) and fish should be present in humans' daily diet next to vegetables and fruits [7, 9].
Foods with an animal origin have a specific texture, flavor and a higher palatability than the ones of vegetal origin. "Nutrient-dense foods of animal origin are used to prevent or treat the most global nutrition" [2].
The affirmations mentioned above reflects how important are farm animals and justify why animal sector should be developed in any country.

Romania is recognized as a country with a high potential for agriculture development both in the vegetal and animal sector.

Among the EU member states, Romania comes on the 1st position for its most numerous farms accounting for 2.88 million, but also it is on top position for the number of farms raising animals whose share in the total number of agricultural holdings is 61%, of which 25% animal farms and 36% mixed farms [10, 57, 61].

The small scale farms are especially subsistence and semi subsistence family farms which dominate animal growing and just a few are commercial companies mainly dealing with poultry and pig farming.

According to Eurostat, in 2020, in total animal output, the main contributors in Romania were: milk 25.3%, pigs 22.6%, eggs 15.7%, poultry 12.8% and cattle 8.5% [11].

***Cattle***, especially dairy cows and buffalos accounts for about 88 % in total milk production and together with sheep and goats assure the farmers' family consumption and also the raw milk needed by dairies [33, 34, 45].

Also, they are a source of meat (beef and veal) being consumed in Romania besides poultry and pork, but these sorts of meat and also exported in the Western countries [26, 39, 46].

***Pigs*** are grown in Romania as pork is a traditional meat used in many preparations, but, despite that, during the last years, the people has become more oriented to poultry meat which is cheaper and healthier having less cholesterol [3, 40, 52].

***Sheep and goats*** are raised for their milk, meat and wool and also because they are a symbol of pastoralism which offer jobs, income and food for the people in the rural areas mainly in the mountain regions [4, 5, 8, 29, 45].

Also, the live sheep are exported to the Arabian countries, and this brings foreign currency in the payment balance [6].

***Poultry*** farming is the object of the business of the integrated commercial companies, but also in the small traditional family farms, their meat being produced faster than pork or beef and the price is more convenient for consumers. Eggs are a part of human diet and that's why egg market is continuously diversifying and developing [16, 17, 18, 49].

The highest number of holdings are raising poultry, being followed by pig farms, bovine and sheep and goat farms**.**

***Beekeeping*** is also a traditional job in the country mainly for its role as additional income source and for the special quality and nutritional value of honey and benefits of other bee products [27, 42,].

The special high quality of honey produced in Romania is a reason to produce more for export where the market requirements in the Western countries are higher [15, 23].

To produce more honey, means to extend the apiary size developing the number of bee families and strengthening their power. The higher the apiary size, the higher the honey production and beekeeping profitability [20].

In this context, the purpose of the paper was to evaluate the development of animal sector in Romania's agriculture by studying the dynamics of animal live stock and production in the period which passed from the country access into the EU, more exactly from 2007 till 2020. The interest is to notice the trends and quantify in what measure animal farming is developing from a period to another. For this reason, two periods of seven years were compared, P1- 2007-2013 and P2- 2014-2020, and the differences between P2 and P1 have been expressed in absolute and relative values. Finally, it was determined the contribution of animal sector to the agricultural production value as a performance indicator across the time series.

## MATERIALS AND METHODS

For setting up this study, the data from National Institute of Statistics regarding the number of farm animals and animal production by species were collected for the interval 2007-2020.

The evolution of these indicators was illustrated in graphics and the trend line was explored based on the adequate regression equations according to the distribution of the variables along the time series. In the study there were utilized both polynomial regression of the 2nd degree, $Y = ax + bx + c$ and linear

regression, Y = bx +a, suitable to each indicator.

R square was calculated simultaneously with the regression equations in order to show in what measure the variation of the variable taken into consideration depended on time.

Fixed basis index was calculated using its well known formula $I_{FB}= (X_n/ X_1) \times 100$ and interpreted to show the growth or decline rate in the studied period.

Structural index, $S_{\%}$, was utilized to reflect the share of the contribution of each animal species to animal production value.

The period was divided into two sub-periods of seven years, P1- 2007-2013 and P2 2014-2020 in order to assess in what measure P2 was superior to the achievements carried out in P1, based on the calculated absolute differences, P2-P1, and relative differences [(P2-P1)/P1] x100.

The results were mainly illustrated and also tabled, being accompanied by the corresponding comments.

Finally, the main ideas resulting from this research were presented within the conclusions.

## RESULTS AND DISCUSSIONS

### Dynamics of animal livestock in Romania in the period 2007-2020

-*The number of bovines* has continuously decreased from 2,818,983 heads, the maximum level, in the year 2007 to 1,875,169 heads in the year 2020, reflecting a reduction by 33.5% (Fig. 1).

The reproduction and milking livestock, dairy cows and buffaloes, has also declined from 1,596,199 heads in 2007 to 1,146,176 heads in 2020, meaning by -28.2%.

This situation in the bovine livestock is caused by multiple factors.

The low milk price was and still is a high risk factor for dairy farmers because they have high production costs and the price barely covers them [19].

The gross product value determined by marketed milk and milk price is sometimes not enough to cover the variable costs and assure a high gross margin and profit [21, 22, 30, 31].

Sometimes, milk quality does not meet the standards, and the processors reject milk collection or offer a lower price [58].

In the last years, the imports of powdered milk, preferred by processors instead of the collection of the local raw milk, have affected milk producers who were obliged to sell milk in Bulgaria [41, 44].

The low price per kg live weight at slaughter imposed by processors also is one of the causes why the fattened bovine live stock declined.

In addition, the severe droughts for a long period of time during the last decade led to a reduced forage production which was not enough to feed the whole number of animals in a farm and the farmers decide to diminish the farm size. Being a high demand of forage and low production, forage price has increased very much leading to higher production costs, in which forages have a share of more 70% [31, 33].

The lack of labor force in the farms is also a limiting factor which could cause the reduction of bovine live stock.

The decline in the number of cows and heifers representing the reproduction livestock was the result of a weak reproduction programme, the low percentage of the artificial insemination in the most of farms and the use of common practice of natural mating mainly in the small subsistence and semi-subsistence farms whose number is dominant. More than this, poor maintenance of the cows and calves and the taxes that the breeders have to pay for animal grazing the adult and young bovines increased expenses and diminish profit.

The state aids in terms of subsidies are allotted only to individual enterprises and family farms, authorized physical persons who keep a producer certificate for animal breeders and juridical persons dealing with animal farming. These aids are sometimes not enough to help the farmers.

Farmers have not enough financial support to sustain investments for modernization of the cows sheds and improve technical endowment [24].

-*Pig livestock* registered a similar downward trend in the studied interval from 6,564,907 heads to 3,784,504 heads in 2020 (Fig. 1).

The decline in the pig livestock was caused by the low offer of piglets on the domestic market and the high price for their acquisition, the increased price for fodder, electricity and water, the lack of labor force, the low price at farm gate offered by processors per kg live weight for pigs destined to be delivered to the slaughter houses, the competition of the imported pork at lower prices affecting the local pig breeders.

In addition the African Swine Fever had deeply affected the swine livestock which favored the imports of pork to cover the requirements of the internal market. The extent of swine fever could not be stopped by the weak measures taken against the wild boars accused by pig breeders as being the main vector of the virus. Also, the lack of security and hygiene norms in the small individual households have favored the spread of this disease [60].

The unbalance ratio between the internal pork offer and demand has led to the increase in pork price and encouraged the invasion of the imported meat.

-*Sheep and goats livestock* had a completely different evolution, being characterized by an upward tendency. If in 2007, Romania had 8,469,195 sheep and 865,070 goats, in the year 2020, their number reached 10,281,473 sheep and 1,611,785 goats, being by 24.95% and, respectively, by 86.3% more numerous (Fig. 1).

The increase of the number of sheep and goats was stimulated by the incentives offered to the breeders to sustain this sector in order to maintain a stable income for agriculturists and preserve the cultural heritage in Romania regarding the specificity of pastoralism and of high quality products from these species, which give their contribution to food security and safety, and also to the preservation of the environment quality, the beauty of landscapes and biodiversity [8, 45].

The state aids for sheep and goats breeders imposed to fulfill the criteria regarding the minimum number of 50 female sheep/25 female goats which are older than one year, but not to exceed 8 years for females and 6 years for rams, the livestock to be registered in the National Registry of Agricultural Holdings, the flock to be retained for 100 days since the date of the payment request. The request of the aid is for minimum 150 and maximum 500 heads of female or rams and the animals to be registered in the genealogic Registry [65].

The raising of these species has an important economic, social and environment impact in the rural areas and also in the mountain areas and isolated regions. Sheep and goats growing offers jobs and is an income source which could diminish the migration of the youth to the cities and maintain a decent living standard to the inhabitants living in the rural areas.

-*The number of bee families* registered an ascending trend from 982,368 in 2007 to 1,879,611 in 2020, meaning a surplus of 91.33% (Fig. 1).

The development of beekeeping is stimulated by the request of more high quality honey and other bee products like polen, propolis, wax, royal jelly, venon etc. even though in the domestic market the demand is slowly increasing and reached about 0.8-0.9 kg per inhabitant and year, but the demand in the Western European countries for Romanian honey is higher and higher [59].

For this reason, the national bee genetic fund of Apis mellifera Carpatica has to be preserved, the number of hives and bee families have to be increased and the melliferous resources to be better valorized. In addition, bee families contribute to the maintenance of biodiversity, beekeeping is a pleasant outdoors job and an additional income source.

The higher the number of bee families per apiary, the higher the economic efficiency in beekeeping [28].

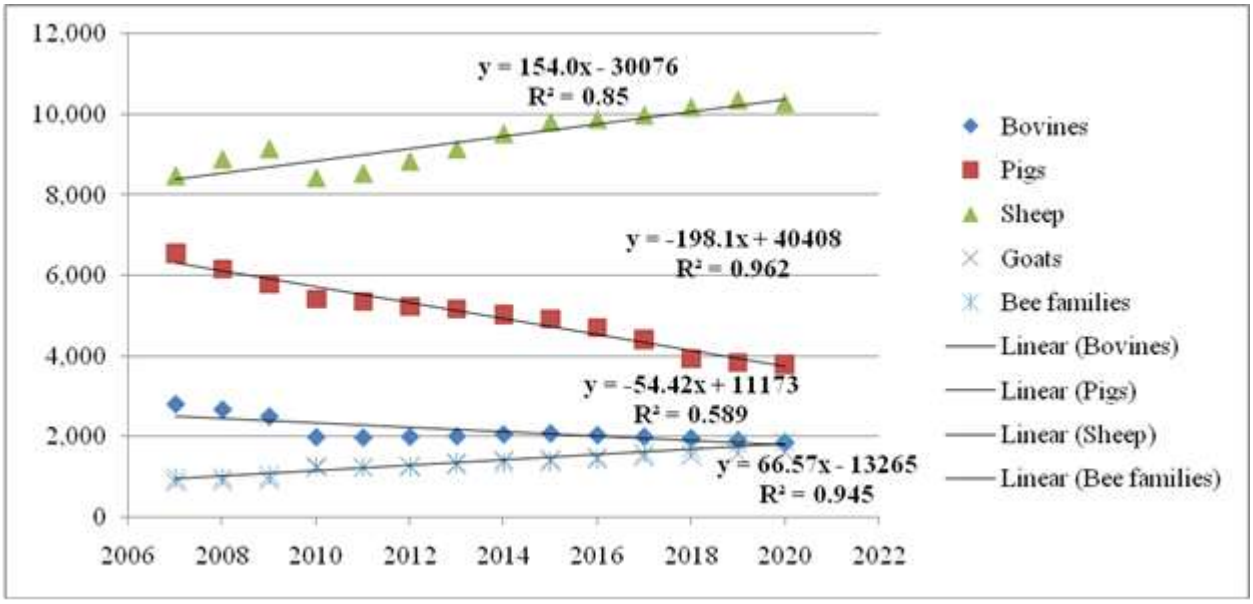


Fig. 1. Dynamics of bovine, pig, sheep, goats livestock and bee families in Romania, 2007-2020 (thousands)
Source: Own calculation and design based on the data from NIS, 2023[14].

-*Poultry livestock* declined from 82,035,594 heads in 2007 to 71,183,431 heads in 2020, accounting for 13.33% less (Fig. 2).

The number of adult egg layers decreased by 19.94%, from 45,207,992 heads in 2007 to 36,648,478 heads in 2020.

Such a loss resulted in a lower egg production both for consumption and reproduction in these 14 years. This also influenced the share of adult layers in poultry livestock and also egg production from 55.10% in 2007 to 51.48% in 2020.

Despite that of the high increase in poultry meat consumption due to its high quality and nutritive value (protein richness, low content of cholesterol), the poultry livestock declined, but in a smaller proportion than in case of bovine and pig live stock.

The high input prices for one day chickens, concentrated fodder, electricity and water, have also contributed to the decline in poultry livestock.

In addition, the high costs to align the raising of the laying hens, according to the EU direction to improve the birds welfare have discouraged a part of the poultry breeders.

However, all the EU countries, including Romania, have aligned the dimension of the raising cages for laying hen to the EU new standard (enlarged cages) for assuring birds welfare. In Romania, on the eggs produced in the comfortable cages in batteries in the industrialized commercial poultry companies, it is mentioned the alphanumeric code "3".

In 2018, the number of laying hens grown in enlarged cages in batteries accounted for 4,790 thousand heads, representing 14.7% of the total number of laying hens in Romania of 32,552 thousand heads.

In addition, from the total poultry live stock raised in industrial farms, 36.1% birds are raised at the ground in sheds, 3% in sheds and outdoors and 1% in an organic system [1].

The more visible appearance of the imported eggs, especially from Poland, which are sold in the domestic market at lower prices compared to the high price which needs to cover the production cost obtained in poultry farming in Romania, has also affected the reduction of the number of laying birds.

Organic farming is an alternative to classical growing systems and environmentally friendly solution in Romania and is destined to be extended in the animal sector too for providing healthier foods and assure food safety to the population.

In 2018, only 2.7% of Romania's agricultural area was covered by organic farming. In the animal sector, in that year, there were raised "138,678 animals, of which 77,175 poultry (55.7%), 42,047 sheep and goats (30.3%) and 19,400 cattle (14.0%). Also, 190,000 bee families were kept in organic beekeeping" [63].

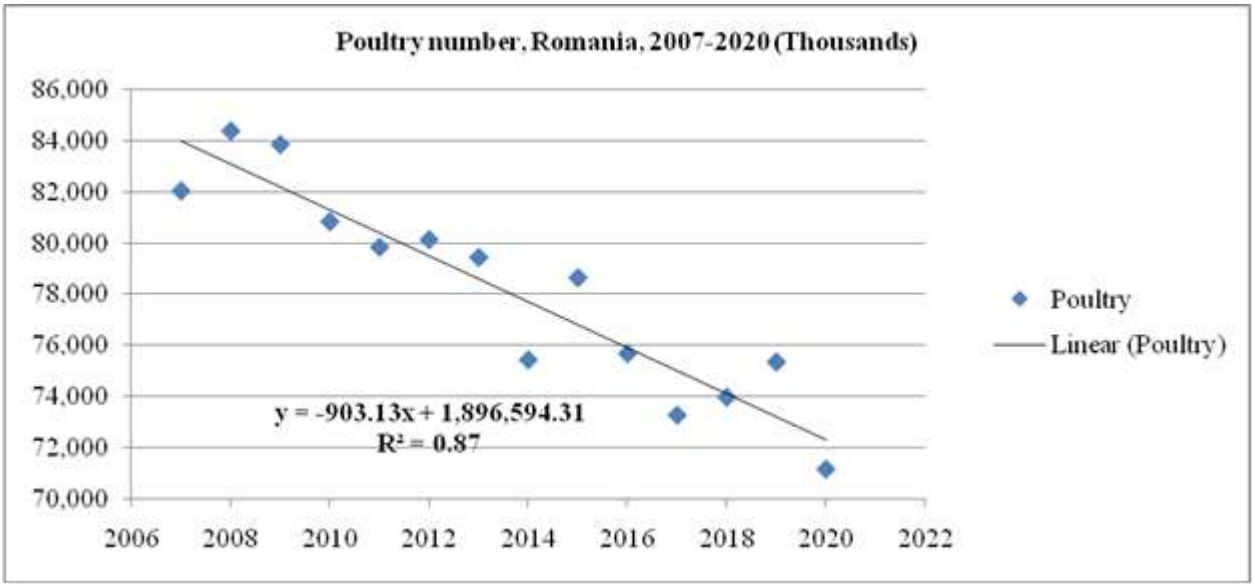


Fig. 2. Dynamics of poultry number in Romania, 2007-2020 (thousands)
Source: Own calculation and design based on the data from NIS, 2023 [14].

In the year 2020, the period of the Covid-19 had a negative impact on the bovine, swine and poultry sectors where the acquisition price was diminished, the transport of the animals to the direct delivery or processing in the market was prohibited or limited by various restrictions which led to the decline of the number of animals and to the disturbance of the supply chains. This aspects resulted in losses for animal breeders, due to the interdictions of labor mobility, the impossibility of deliveries to processors, and the stopping of retail deliveries to HoReCa, aspect which produced an economic disturbance in animal farming.

The comparative situation regarding the animal livestock in the P1, that is 2007-2013 and P2 2014-2020, since Romania integrated its agriculture into the EU, is presented in Table 1, which reflects the following aspects:

-In the period 2014-2020, it was registered an average bovine livestock per decade accounting for 1,999,682 heads, being by 12.78% smaller than in the previous decade 2007-2013. Also, the average number of dairy cows and buffaloes decreased by 11.40% in P2 versus P1.

-The multiannual average of pig number in P2 was 4,375,196 by 22.94% smaller than the multiannual mean in P1.

-Compared to P1, 2007-2013, in the Interval P2, 2014-2020, the multiannual average of sheep number was 10,000,235 heads, being by 13.98% higher.

-At the same time, the average number of goats in P2 accounted for 1,512,815 heads, meaning by 36.88% higher than in the previous P1 period.

-The average poultry livestock accounted for 74,800,061 heads in P2, which means a reduction by 8.3% compared to the number of poultry in P1.

Also, the laying birds registered a multiannual average of 40,151,041 heads in P2, meaning a decrease by 10.41 % compared to the previous period.

-In case of the number of bee families, the multiannual average accounted for 1,599,404 in P2 compared to P1 (Table 1).

**Dynamics of animal production in Romania in the period 2007-2020**

***(a)Dynamics of animal live weight at slaughter for consumption***

*-The total live weight of the animals destined to slaughter* registered a decline from 1,502,791 tons in the year 2007 to 1,462,047 tons in the year 2020, meaning a reduction by 2.78% (Fig. 3).

Table 1. The multiannual average of animal livestock in the period P2-2014-2020 versus P1- 2007-2013

| | MU | Multiannual average in P1-2007-2013 | Multiannual average in P2-2014-2020 | Absolute differences P2-P1 | Percentage difference [(P2-P1)/ P1]x 100 ( %) |
|---|---|---|---|---|---|
| Bovines | Heads | 2,290,925 | 1,999,682 | -291,243 | -12.72 |
| Dairy cows and buffaloes | Heads | 1,320,399 | 1,169,953 | -150,446 | -14.40 |
| Pigs | Heads | 5,676,937 | 4,375,196 | -1,301,741 | -22.94 |
| Sheep | Heads | 8,773,234 | 10,000,235 | +1,227,001 | +13.98 |
| Goats | Heads | 1,105,179 | 1,512,815 | +407,636 | +36.88 |
| Poultry | Heads | 81,501,947 | 74,802,061 | -6,699,886 | -8.3 |
| Adult laying birds | Heads | 44,813,285 | 40,151,041 | -4,662,244 | -10.41 |
| Bee families | Number | 1,167,242 | 1,599,404 | +432,162 | +37.02 |

Source: Own calculation based on the data from NIS, 2023 [14].

This situation was determined by the changes in the number of live animals destined to slaughter for consumption and of their average weight at slaughter.

-*The live weight of bovines* destined to slaughter for consumption decreased by 48.59% (Fig. 3).

This situation was caused by the decline in the bovine livestock, especially regarding the number of fattened young steers and also of their weight at delivery to the slaughter houses. The low average price offered by processors per kg live weight at slaughter has determined a part the breeders to diminish the number of animals destined to fattening or to quip as production cost could not be covered by the offered price at the farm gate [13].

This had a negative consequence on farmers income and also on beef and veal production and marketed meat in comparison with consumption requirements.

-*The live weight of the slaughtered pigs* also went down by 21.70%, mainly as a result of the decline in pig livestock, the causes being presented in the previous paragraph (Fig. 3).

Romania is one of the most important pork producing country in the EU and a period of time was also an exporting country [37].

In the period of swine fever, the pig livestock was deeply affected, hundreds of thousands of pigs had to be killed even in the industrial complexes [53, 54].

- *The live weight of sheep and goats* increased by 9.86%, due to the growth of the number of animals of these species slaughtered to cover the growth of the domestic demand and in a smaller proportion for export (Fig. 3).

However, Romania is an important producer of sheep and goat meat in the EU [62].

The meat from these species is consumed by a part of the population in Romania, especially by sheep and goats breeders, but also by other people aware of its special quality: red meat but with a low cholesterol, a special taste, smell and texture, and traditional delicious dishes [5, 29, 45].

-*The live weight of the slaughtered poultry* registered a substantial growth accounting for +59.56% in the analyzed 20 years (Fig. 3).

The increased live weight at slaughter depended on the number of birds especially fattened for this purpose, that is broilers chickens coming from specialized hybrids with high daily gain performance and with a high live weight in maximum 33 days of fattening. Also, the adult poultry, at the end of the exploitation period either for reproduction or egg production, were slaughtered and meat parts were commercialized.

Farmers are satisfied with this business which could bring them profit in a short period of time.

Consumers are more and more oriented to poultry meat due to its high value protein, less cholesterol compared to pork, accessible acquisition price and large variety of tasty and flavored preparations [17].

The contribution of the species to the total live weight of the slaughtered animals for consumption is comparatively shown in the year 2020 versus 2007 in Figure 4.

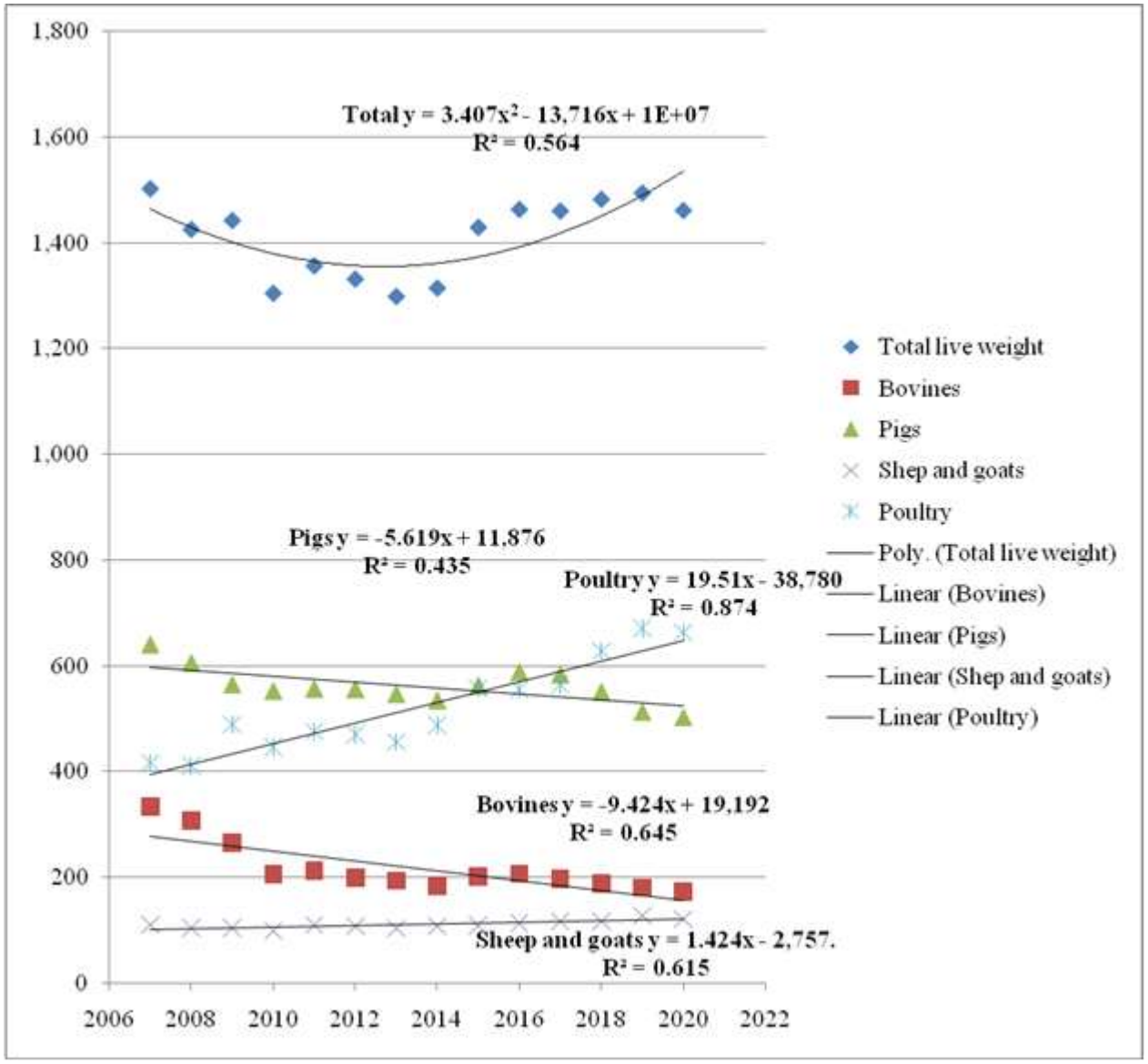


Fig. 3. Dynamics of the live weight of animals destined to slaughter for consumption by species, Romania, 2007-3020

Source: Own calculation and design based on the data from NIS, 2023 [14].

From the data, we may easily notice that important changes happened in 2020 compared to 2007 which reflect that the share of bovines declined by 10.18 percentage points, the share of pigs decreased by 8.37 pp, while the share of sheep and goats increased by 1.1 pp and the share of poultry also increased but by 17.37 pp.

Therefore, in the year 2020, the poultry passed on the 1st position with a share of 45.10% compared to pigs which passed on the 2nd one. In this year, the share was higher by 17.37 percentage points than in 2007.

This is explained by the higher and higher preference of the Romanians for a healthier diet where poultry meat to be the source of high quality protein, less cholesterol, multiple uses for preparing various meals and all these at a lower selling price compared to pork.

On the 2nd position are pigs having a share of 34.36% in the total live weight of the slaughtered animals for consumption.

Their share is smaller by 8.37 percentage points than in the year 2007. This position is still fine as long as pork is a traditional meat sort in Romania, still preferred by many consumers.

Bovines came on the 3rd position with a share of 12.02 % in 2020, which is by 10.18 pp smaller than in 2007.

The decline is explained by the fact the beef and veal are more expensive than the other sorts of meat and also the consumers preference is more oriented to poultry meat and pork.

Finally, the share of sheep and goats in the total live weight at slaughter for consumption is on the last position and accounted for 8.53% in 2020 being by 1.19 pp higher than in the year 2007.

The slight increase is determined by a slight growth in mutton, lamb and goat meat consumption (Fig. 4).

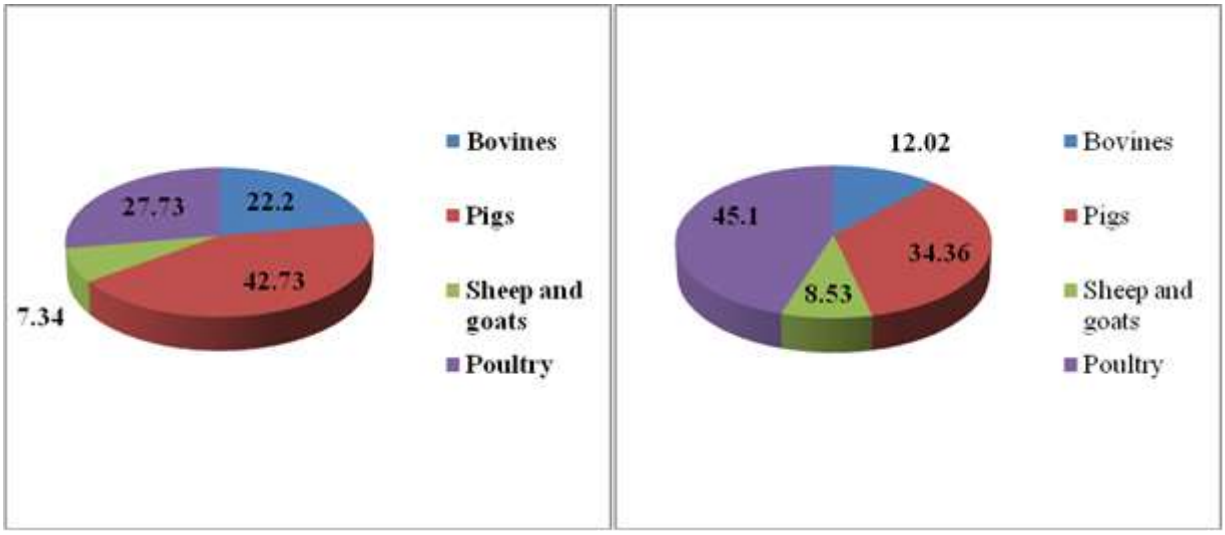


Fig. 4. Contribution of the species to the total live weight of the animals slaughtered for consumption in 2007 ( left) and 2020 (right), %

Source: Own calculation and design based on the data from NIS, 2023 [14].

***(b)Dynamics of milk production***

Milk production decreased from 54,875 thousand hl in 2007 to 46,357 thousand hl in 2020, meaning a reduction by 15.53%.

This was due to the decline in the milking livestock represented especially by cows and also, in a lower measure by buffaloes. But, sheep and goats had a positive influence on milk production as their number registered a considerable growth.

In addition, yield level per milking animal is still low and its variation depends on breed and genetic gain conferred by breeding program applied by farmer, the use of artificial insemination with frozen semen from the high breeding value bulls, growing system, feeding conditions, forage production, maintenance conditions and farm size.

Milk production coming from cows and buffaloes had a decreasing trend from 50,957 thousand hl in 2007 to 35,888 thousand hl in 2020, reflecting a loss of 29.58%.

At the same time, milk coming from sheep and goats registered an upward trend from 3,988 thousand hl in 2007 to 6,455 thousand hl in 2020, reflecting a growth rate of 61.86%. This ascension was stimulated by the growth of sheep and goat milking live stock (Fig 5).

The contribution to milk production by species changed a little in the analyzed interval.

Milk produced by dairy cows and buffaloes remained on the top position, but its share in the total production declined from 92.8% in 2007 to 84.7% in 2020, while the weight of sheep and goats contribution increased to 15.3% in 2020 compared to 7.2% in 2007.

This is a consequence of the decline in dairy cows and buffaloes live stock and the increase in sheep and goats milking live stock [38, 55, 62].

Milk production must meet consumption requirements and internal production is enough, but the common market allowed as milk and dairy products of foreign origin to appear on the shelves of the supermarkets [34, 35].

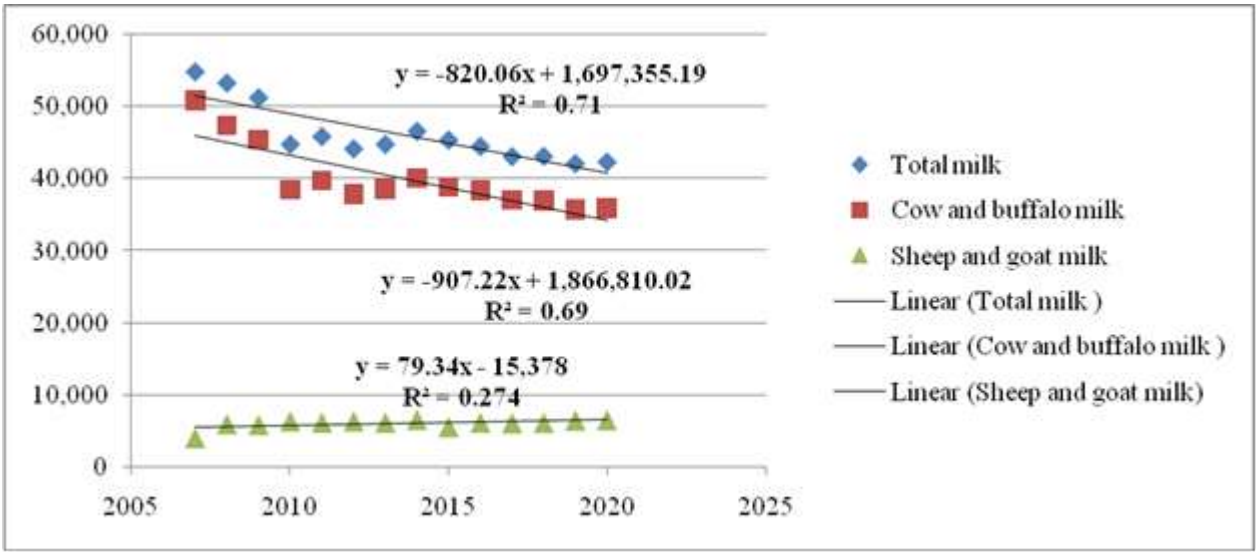


Fig. 5. Dynamics of milk production, Romania, 2007-2020 (Thousand hl)
Source: Own calculation and design based on the data from NIS, 2023 [14].

An increasing preference was noticed regarding the dairy products carried out of sheep and goats milk which are sorts with a special quality regarding the small size of the fat globules which allows them to be easily assimilated. For this reason this milk sort is recommended for treating the persons with lung and intestinal diseases etc. [64].

Also, the cheese sorts have a specific flavor and taste and this has stimulated the extend of production and offer in the EU, at the global level and also in Romania [25, 32].

***(c)Dynamics of egg production***

The reduction in poultry live stock, especially of laying birds, had an important impact leading to a downward trend in egg production, which decreased from 6,522 million pieces in the year 2007 to 5,446 million pieces in 2020, meaning a loss by 16.5% (Fig. 6).

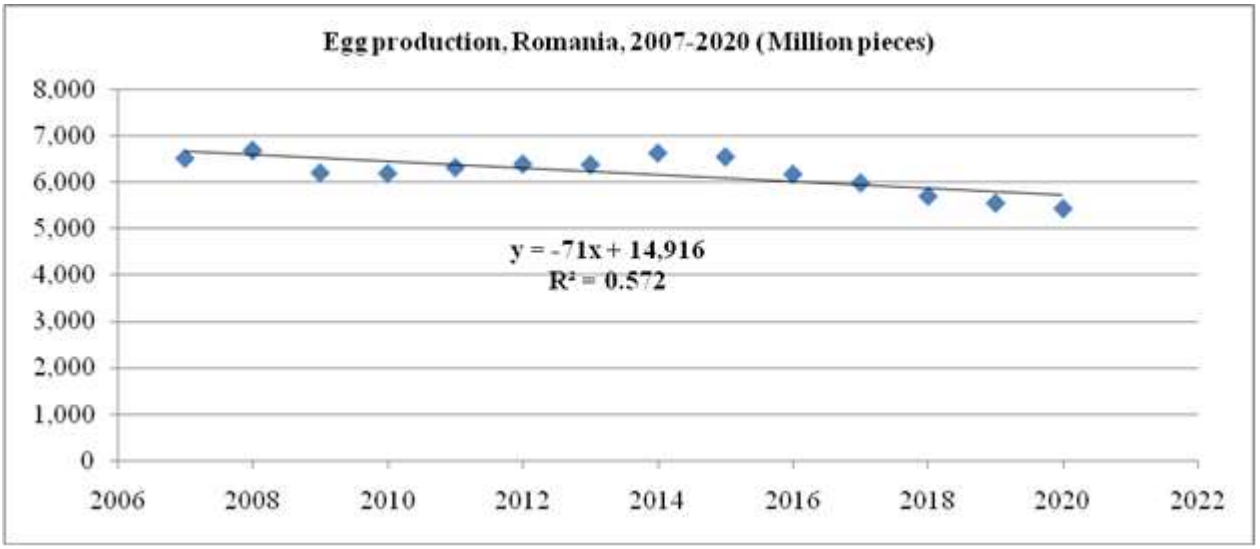


Fig. 6. Dynamics of egg production, Romania, 2007-2020 ( Million pieces)
Source: Own calculation and design based on NIS data, 2023 [14].

As mentioned before, the laying birds stock decline due to the higher production costs including one day chickens, concentrated fodder, electricity, water, transportation, fuel.

To diversify the offer on the Romanian market, there are also sold imported eggs mainly from Poland which compete with the eggs carried out by the local industrial poultry complexes and other breeders.

About 16% of the total egg production is achieved from the laying hens raised in improved cages in batteries, and the rest in the other growing systems: at the ground in sheds, in sheds and outdoors and in the organic system [1, 16, 18, 49].

***(d)Dynamics of wool production***

Wool production recorded a variation in the analyzed interval. In 2020, it accounted for 23,289 tons, being by 10.76% higher than in 2007.

However, from 2007 to 2013, it recorded a decline reaching the minimum level of 20,719 tons., but then the support offered by Ministry of Agriculture to sheep and goats breeders sustained the growth of the livestock, milk and meat production, and led to a higher wool production (Fig. 7).

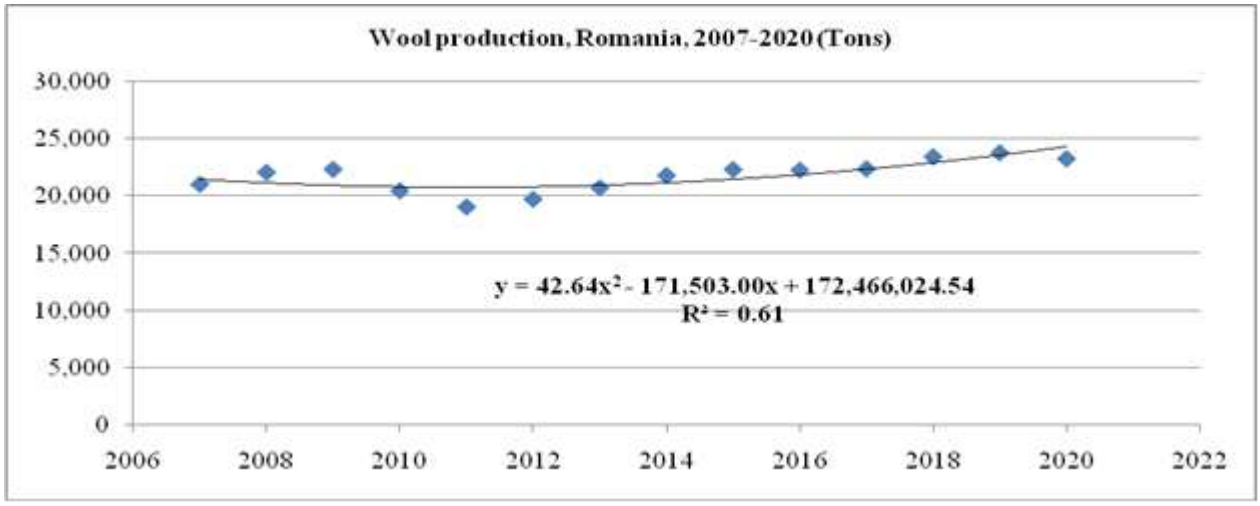


Fig. 7. Dynamics of wool production, Romania, 2007-2020 ( tons)
Source: Own calculation and design based on NIS data, 2023 [14].

***(e)Honey production***

Honey production increased in the studied period from 16,767 tons in 2007 to 30,724 tons in 2020, meaning by +83.24% (Fig. 8).

This was a result of the incentives given to beekeepers to grow the number of bee families buying new hives, selected and high value bee queens, bee swarms, pavilion for the transportation of hives in the pastoral, centrifuge for honey extraction from honeycombs and other tools needed in the apiary.

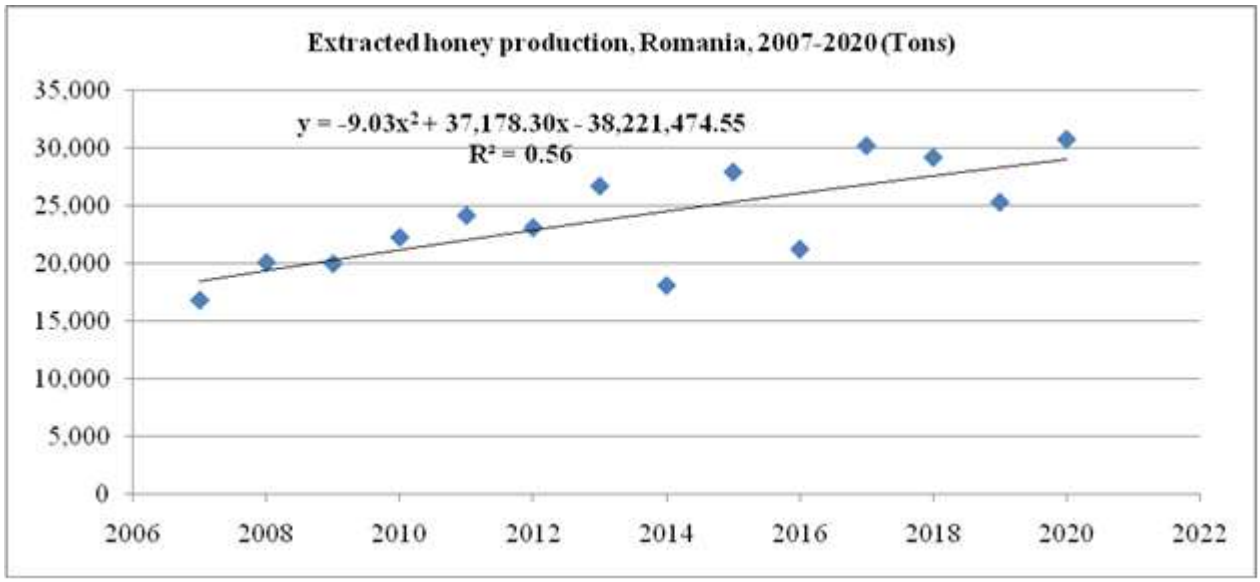


Fig. 8. Dynamics of extracted honey production, Romania, 2007-2020 ( tons)
Source: Own calculation and design based on NIS data, 2023 [14].

The funds came from the EU and Ministry of Agriculture for stimulating beekeeping sector to produce more honey especially for export, as in Romania the average yearly consumption per inhabitant is smaller than in the Western countries [43, 47, 48].

**Comparison regarding animal production in the period P2- 2014-2020 and P1- 2007-2013**

***Live weight of the slaughtered animals for consumption***

The average live weight of the slaughtered animals for consumption was by 4.62% higher in P2 than in P1.

A high and positive contribution had the poultry sector accounting for 45.10% in 2020 compared to only 27.73% in 2007. In P2, it was recorded a surplus of 30.46% live weight compared to P1, even though the number of poultry declined, but their live weight at slaughtered increased based on the broilers and adult poultry.

Also, a positive influence had the sheep and goats whose number raised with a deep impact on the mutton and Easter lamb production, whose consumption has slightly increased being a red meat with less cholesterol and also a traditional meat at Easter and in the mountain areas. In Romania, there are specific dishes made of this sort of meat like: lamb soup, lamb stew, lamb tripe, mutton pastrami etc.

In P2, the live weight of sheep and goats at slaughter increased by 9.83% versus P1.

The live weight of the slaughtered bovines had a negative impact on the total live weight as in P2 it decreased by 22.64% versus P1. This was determined especially by the high reduction in live stock and also in the average weight at slaughter.

In addition, the reduction of the number of pigs had a negative impact. In P2, it was registered a loss of 5.18% live weight compared to P1.

***Milk production*** continued to decline in P2 being by 8.95% smaller than in P1. The main causes of the downward trend consisted of: the decrease in the number of dairy cows and buffaloes, the low yield level, milk quality, low acquisition price at farm gate, the more preferred powdered milk by processors.

Table 2. Average animal production inP2- 2014-2020 versus P1- 2007-2013, Romania

| | | **Multiannual average P1-2007-2013** | **Multiannual average P2- 2014-2020** | **Absolute differences P2-P1** | **Relative differences [(P2-P1)/ P1]x 100 ( %)** |
|---|---|---|---|---|---|
| Total animal live weight at slaughter for consumption (Tons) | Mean | 1,380,931 | 1,444,801 | +63,870 | +4.62 |
| | Total | 9,666,517 | 10,113,607 | +447,090 | +4.62 |
| -Bovine live weight (Tons) | Mean | 244,549 | 189,166 | -55,383 | -22.64 |
| | Total | 1,711,843 | 1,324,162 | -397,681 | -22.64 |
| -Pigs live weight (Tons) | Mean | 577,496 | 547,549 | -29,897 | -5.18 |
| | Total | 4,042,472 | 3,832,843 | -209,629 | -5.18 |
| -Sheep and goats live weight (Tons) | Mean | 105,535 | 115,912 | +10,377 | +9.83 |
| | Total | 738,745 | 811,384 | +72,639 | +9.83 |
| -Poultry live weight (Tons) | Mean | 452,369 | 590,162 | +137,794 | +30.46 |
| | Total | 3,166,583 | 4,131,141 | +964,558 | +30.46 |
| Milk production (Thousand hl), of which: | Mean | 52,362 | 47,671 | -4,691 | -8.95 |
| | Total | 366,534 | 333,697 | -32,837 | -9.95 |
| Cow and buffalo (Thousand hl) | Mean | 41,647 | 37,575 | -4,072 | -9.77 |
| | Total | 291,529 | 263,025 | -28,504 | -9.77 |
| Egg production (Million pieces) | Mean | 6,391 | 6,013 | -378 | -5.91 |
| | Total | 44,737 | 42,092 | -2,645 | -5.91 |
| Wool production (Tons) | Mean | 20,766 | 22,772 | +2,006 | +9.67 |
| | Total | 145,367 | 159,410 | +14,063 | +9.67 |
| Extracted Honey production (Tons) | Mean | 21,833 | 26,067 | +4,234 | +19.39 |
| | Total | 152,839 | 182,467 | +29,637 | +19.39 |

Source: Own calculation based on the data from NIS, 2023 [14].

As mentioned before, the laying birds stock decline due to the higher production costs including one day chickens, concentrated fodder, electricity, water, transportation, fuel.

To diversify the offer on the Romanian market, there are also sold imported eggs mainly from Poland which compete with the eggs carried out by the local industrial poultry complexes and other breeders.

About 16% of the total egg production is achieved from the laying hens raised in improved cages in batteries, and the rest in the other growing systems: at the ground in sheds, in sheds and outdoors and in the organic system [1, 16, 18, 49].

***(d)Dynamics of wool production***

Wool production recorded a variation in the analyzed interval. In 2020, it accounted for 23,289 tons, being by 10.76% higher than in 2007.

However, from 2007 to 2013, it recorded a decline reaching the minimum level of 20,719 tons., but then the support offered by Ministry of Agriculture to sheep and goats breeders sustained the growth of the livestock, milk and meat production, and led to a higher wool production (Fig. 7).

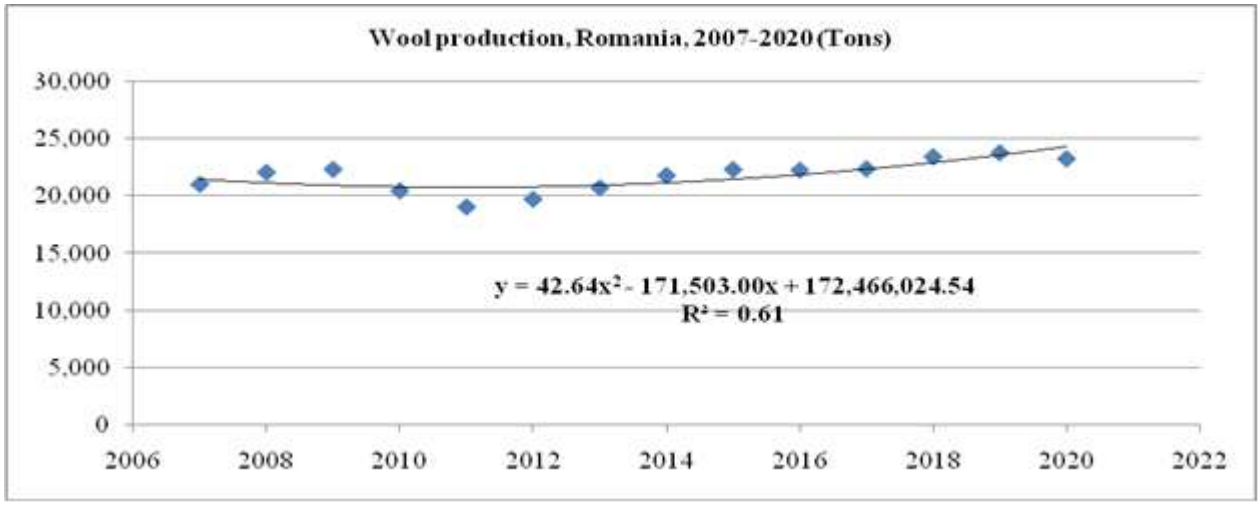


Fig. 7. Dynamics of wool production, Romania, 2007-2020 ( tons)
Source: Own calculation and design based on NIS data, 2023 [14].

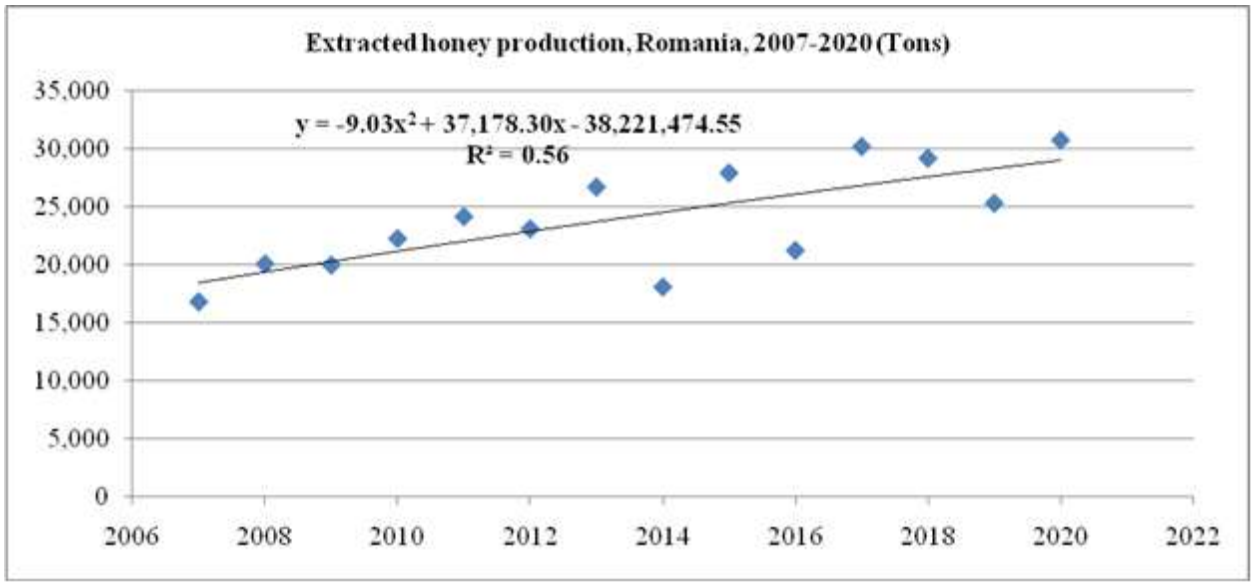


Fig. 8. Dynamics of extracted honey production, Romania, 2007-2020 ( tons)
Source: Own calculation and design based on NIS data, 2023 [14].

***e)Honey production***

Honey production increased in the studied period from 16,767 tons in 2007 to 30,724 tons in 2020, meaning by +83.24% (Fig. 8).

This was a result of the incentives given to beekeepers to grow the number of bee families buying new hives, selected and high value bee queens, bee swarms, pavilion for the transportation of hives in the pastoral, centrifuge for honey extraction from honeycombs and other tools needed in the apiary.

The funds came from the EU and Ministry of Agriculture for stimulating beekeeping sector to produce more honey especially for export, as in Romania the average yearly consumption per inhabitant is smaller than in the Western countries [43, 47, 48].

**Comparison regarding animal production in the period P2- 2014-2020 and P1- 2007-2013**

***Live weight of the slaughtered animals for consumption***

The average live weight of the slaughtered animals for consumption was by 4.62% higher in P2 than in P1.

A high and positive contribution had the poultry sector accounting for 45.10% in 2020 compared to only 27.73% in 2007. In P2, it was recorded a surplus of 30.46% live weight compared to P1, even though the number of poultry declined, but their live weight at slaughtered increased based on the broilers and adult poultry.

Also, a positive influence had the sheep and goats whose number raised with a deep impact on the mutton and Easter lamb production, whose consumption has slightly increased being a red meat with less cholesterol and also a traditional meat at Easter and in the mountain areas. In Romania, there are specific dishes made of this sort of meat like: lamb soup, lamb stew, lamb tripe, mutton pastrami etc.

Table 2. Average animal production inP2- 2014-2020 versus P1- 2007-2013, Romania

| | | **Multiannual average P1-2007-2013** | **Multiannual average P2- 2014-2020** | **Absolute differences P2-P1** | **Relative differences [(P2-P1)/ P1]x 100 ( %)** |
|---|---|---|---|---|---|
| Total animal live weight at slaughter for consumption (Tons) | Mean | 1,380,931 | 1,444,801 | +63,870 | +4.62 |
| | Total | 9,666,517 | 10,113,607 | +447,090 | +4.62 |
| -Bovine live weight (Tons) | Mean | 244,549 | 189,166 | -55,383 | -22.64 |
| | Total | 1,711,843 | 1,324,162 | -397,681 | -22.64 |
| -Pigs live weight (Tons) | Mean | 577,496 | 547,549 | -29,897 | -5.18 |
| | Total | 4,042,472 | 3,832,843 | -209,629 | -5.18 |
| -Sheep and goats live weight (Tons) | Mean | 105,535 | 115,912 | +10,377 | +9.83 |
| | Total | 738,745 | 811,384 | +72,639 | +9.83 |
| -Poultry live weight (Tons) | Mean | 452,369 | 590,162 | +137,794 | +30.46 |
| | Total | 3,166,583 | 4,131,141 | +964,558 | +30.46 |
| Milk production (Thousand hl), of which: | Mean | 52,362 | 47,671 | -4,691 | -8.95 |
| | Total | 366,534 | 333,697 | -32,837 | -9.95 |
| Cow and buffalo (Thousand hl) | Mean | 41,647 | 37,575 | -4,072 | -9.77 |
| | Total | 291,529 | 263,025 | -28,504 | -9.77 |
| Egg production (Million pieces) | Mean | 6,391 | 6,013 | -378 | -5.91 |
| | Total | 44,737 | 42,092 | -2,645 | -5.91 |
| Wool production (Tons) | Mean | 20,766 | 22,772 | +2,006 | +9.67 |
| | Total | 145,367 | 159,410 | +14,063 | +9.67 |
| Extracted Honey production (Tons) | Mean | 21,833 | 26,067 | +4,234 | +19.39 |
| | Total | 152,839 | 182,467 | +29,637 | +19.39 |

Source: Own calculation based on the data from NIS, 2023 [14].

In P2, the live weight of sheep and goats at slaughter increased by 9.83% versus P1.

The live weight of the slaughtered bovines had a negative impact on the total live weight

as in P2 it decreased by 22.64% versus P1. This was determined especially by the high reduction in live stock and also in the average weight at slaughter.

In addition, the reduction of the number of pigs had a negative impact. In P2, it was registered a loss of 5.18% live weight compared to P1.

***Milk production*** continued to decline in P2 being by 8.95% smaller than in P1. The main causes of the downward trend consisted of: the decrease in the number of dairy cows and buffaloes, the low yield level, milk quality, low acquisition price at farm gate, the more preferred powdered milk by processors.

Under these condition, milk production achieved by cows and buffaloes decreased by 9.77% in P2 versus P1.

However, the increased contribution to milk production by sheep and goats had a positive impact.

***Egg production*** was by 5.91% smaller in P2 compared to P1 as a result of the decline in the number of laying birds, caused by the high input costs (Table 2).

***Wool production*** increased by 9.67% in P2 versus P1 grace to the growth in live stock. However, wool delivery to processors is a big problem, but the fact that Romanians love traditional handicrafts and carpets, this sort of small business has been developed locally. In addition, wool is also used as raw material in constructions for resistance and protection against heat and cold (Table 2).

***Honey production*** carried out a substantial growth, accounting for 19.29% in P2 versus P1 as the number of beekeepers, apiaries, bee hives and bee families increased as export requires more honey (Table 2).

**Contribution of animal sector to agricultural output value**

The value of animal production increased by 20.42 trillion lei in the 2nd decade when it accounted for 172.31 trillion lei compared to 151.89 trillion lei in the 1st decade, meaning a surplus of +13.44%.

Table 3 presents the comparative situation of the agricultural production value in P2 versus P1 pointing out the absolute and relative differences in the animal sector, vegetal and service sectors.

The figures show that while the vegetal sector and services had an ascending share, animal sector diminished its weight in the total output value.

Table 3. The multiannual average of animal production value compared to vegetal and service sector in the decade 2024-2020 versus the decade 2007-2013 (Million Lei)

| | | **Multiannual average P1- 2007-2013** | **Multiannual average P2-2014-2020** | **Absolute differences P2-P1** | **Relative differences [(P2-P1)/ P1]x 100 ( %)** |
|---|---|---|---|---|---|
| Agricultural production value | Average | 65,472,475 | 78,407,931.7 | +12,935,456.7 | +19.75 |
| | Total | 458,307,325 | 546,855,522 | +90,548,197 | +19.75 |
| Vegetal production value | Average | 43,126,047 | 52,570,705 | +9,444,658 | +21.90 |
| | Total | 301,882,335 | 367,994,984 | +66,112,599 | +21.90 |
| Animal production value | Average | 21,698,813 | 24,616,026 | +2,917,213 | +13.44 |
| | Total | 151,891,691 | 172,312,153 | +20,420,462 | +13.44 |
| Agricultural services value | Average | 647,615 | 1,221,213 | +573,597 | +82.39 |
| | Total | 4,533,309 | 8,548,485 | +4,015,176 | +82.39 |

Source: Own calculations based on the data from NIS, 2023 [14].

Taking into account the agricultural production value increased in 2020 reaching 548.85 trillion lei, being by +19.75% higher than in 2007, the contribution of animal sector to the output value in Romania's agriculture declined from 33.14% in the year 2007 to 31.39% in the year 2020 (Fig. 9).

These structural changes reflect the reality as a way of adaptation of agriculture to market pressure and consumers' preferences [12].

In Romania, animal production will continue to develop in order to better cover the domestic market and create a surplus which to be commercialized on the external market, mainly on the EU market, the key agro-food partner [56].

The high consumption, as a determinant factor of Romania's GDP, reflects the importance of agriculture among other economic sectors which give their contribution to GDP.

In the daily basket, food keeps a high percentage in close relationship with the purchasing power of the population. This means that agriculture has to continue its development to assure a diversified offer of quality agro-food products to meet in a larger proportion the needs of the population of different ages and income level [36, 50, 51].

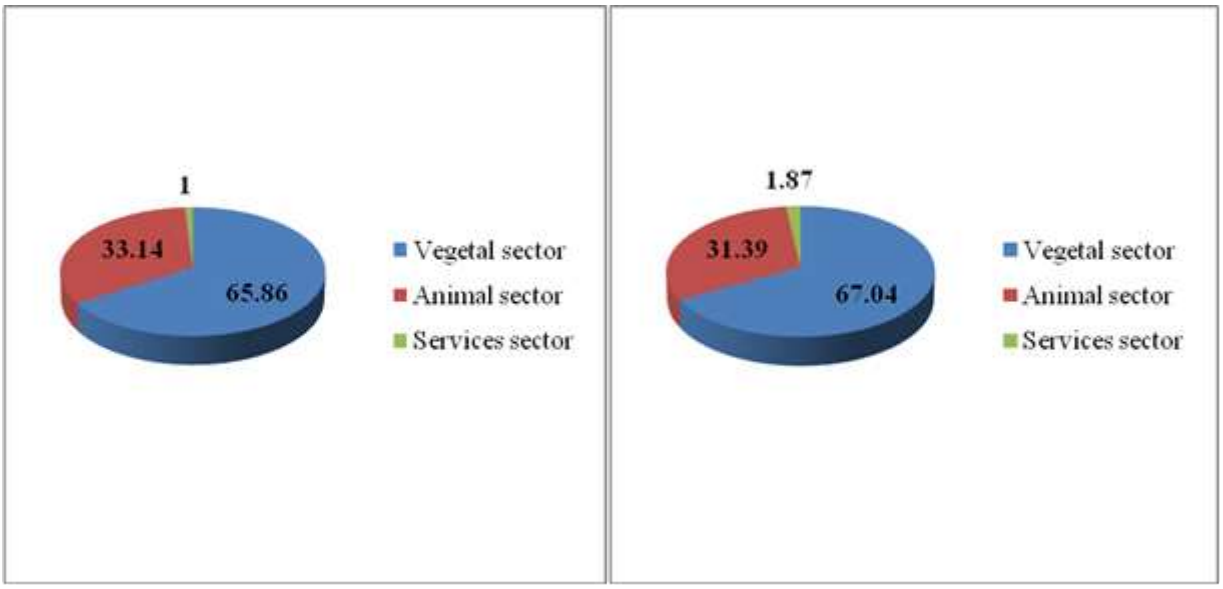


Fig. 9. Contribution of vegetal, animal and services sectors to agricultural production value in 2020 compared to 2007 (%)

Source: Own calculation and design based on the data from NIS, 2023 [14].

## CONCLUSIONS

This research work pointed out the main trends in livestock and animal production in the period 2007-2020 in Romania and offered an overview about what happened in the second period P2 2014-2020 compared to the 1st period P1- 2007-2013.

The analysis of the results reflects the following aspects:

-Regarding livestock, the main trends are different depending on species: while the number of bovines, pigs and poultry decreased, the number of sheep and goats and bee families increase.

-The total animal live weight at slaughter had an downward trend determined by the diminished production in slaughtered bovines and pigs. However, the increase in sheep and goats livestock led to a growth of the live weight of these species at slaughter. Also, the higher performances in poultry fattening had a positive impact.

-Milk production decline and egg production as well, while wool and honey production increased.

-In the second period P2 2014-2020, the situation of animal sector worsened. The bovine, pig and poultry livestock continued to decline. A positive aspect was that the number of sheep and goats and bee families continued to grow.

-The total live weight of slaughtered animals for consumption, implicitly meat production, milk production and egg production continued to go down. However, the poultry live weight and meat had an upward trend and wool and honey production as well.

-As a result, the agricultural production value produced by the animal sector in Romania's

agriculture is much smaller than in the vegetal sector. Its decline continued from a year to another.

-In 2020, the value of agricultural production in animal growing was by +20,420 trillion Lei higher in 2007. More than this, in the analyzed period 2007-2020, the value of agricultural production produced in the animal sector increased by 13.44%, in a lower measure than the value produced by vegetal sector which increased by 21.90%.

-The gaps of production on in the domestic market regarding milk, meat, eggs did not meet consumers' requirements and for this reason domestic demand had to be covered by imports whose volume and value were higher and higher leading to a negative agri-food trade balance.

The decline in animal livestock is not only in Romania, but also in many other EU countries, but there production performance per animal is higher.

Despite that the EU CAP allotted higher funds accounting for 100 Billion Euro in the period 2014-2020 for combating the impact of climate change by reducing the $CO_2$ emissions, the result has been weak.

The emissions generated by animal growing represent 50% of total emission coming from agriculture and remained stable at the level of the year 2010. Under this situation, the CAP measures promote the products of animal origin whose consumption have not registered any decline since 2014.

Therefore, farmers have to set up new strategies for their future business in animal production adapting the technologies which are more friendly with the environment and reduce $CO_2$ emissions.

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# THE EFFICIENCY OF THE EUROPEAN UNION AGRI-FOOD TRADE IN THE DECADE 2013-2022

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***Abstract***

*The paper analyzed the EU agri-food trade based on Eurostat data in the period 2013-2022 in order establish in what measure its commerce is efficient in terms of total trade, export, import, coverage ratio, trade-to GDP, export ratio, net export, share of groups of products in export and import value, growth rate and regression equations. The results highlighted an increase in agricultural output value by 33.77% which enhanced export. The total agri-food trade increased by +61.3% in the analyzed interval, accounting for Euro 424.6 Billion in 2022. Export value reached Euro 229.1 Billion in 2022, being by 58% higher, while import value raised by 65.53%, attaining Euro 195.5 Billion. Net exports were positive and varied between Euro 25.6 Billion in 2015 and Euro 46.9 Billion, the peak attained in 2021. Also, the coverage ratio was over 100% in the whole interval. The exported amounts were higher than the imported ones till 2016, but then imports exceeded exports, except the year 2021. The average export price was superior to the average import price every year. In the analyzed interval, the average export price increased by 37.13%, while import price by 25.71%. Export ratio was over 100 ranging between 119 in 2015, 131 in 2020 and 117 in 2022. The variations in export and import quantities and values produced changes in the share of the groups of products reflecting that in 2022, the hierarchy for export was: Foodstuffs, Animal products, Vegetal products, Fats and Oils, and for import: Vegetal products, Food stuffs, Animal products and Fats and oils. A positive trade balance and coverage ratio over 100 were found in case of Animal products and Food stuffs, and a negative trade balance and a coverage ratio below 100 was registered for Vegetal products and Fats and oils. Agri-food export accounted for 42.9% in agricultural output value in 2022, but the peak was 44.6% in 2018. The regression equation Y = 0.5259 X - 46.0376 shows that an increase by Euro 1 Billion in agricultural output value could raise export value by Euro 0.52 Billion. This research work highlighted the high efficiency in the agri-food trade of the EU in the period 2013-2022. To preserve its position of world leader in agri-food trade, the EU has to continue its CAP reforms oriented to a high performance from an economic, social, environment and food security point of view.*

***Key words*****:** *agricultural output, agri-food trade, net export, coverage rate, groups of agri-food products, EU*

## INTRODUCTION

Trade is considered the main driver of the global economy as it allows the goods traffic from a country to another, division of labor, stimulates productivity, gives a growth to real income and a change in the prices of final goods, balances demand/supply ratio, creates advantages between trade partners [24, 28, 30].

Trade could also have a beneficial effect on real GDP as long as the positive difference between export and import value, named "net exports" is a determinant factor besides economic output, consumers' and government

spending on goods and services, investments in capital goods, income and savings distribution [1, 9].

The EU is among the top three trade players in the word next to China and USA, followed by Japan, South Korea, Canada etc. [10, 6, 7, 35].

The EU enlargement stimulated the open market, free movement of goods and labor force, price liberalization, which had a positive impact on the cost reduction, increase of gross domestic product and internal trade among the EU member states [20, 25].

The EU economic and political integration led to benefits regarding labour productivity, income and GDP per capita [3]. Also the EU enlargement favoured income growth, productivity competitiveness and increase of trade [5].

The creation of the EU unique market without any customs barriers for the members states encouraged and intensified trade exchange with a beneficial effect for the whole community [49].

Therefore, trade is very important for the EU and also the EU has a positive influence on trade [23, 50].

First of all, the EU develops trade within its own internal market with the countries which are EU members and, secondly, it runs an extra trade with other countries at international level. The main EU countries developing trade are Germany, Netherlands, Italy, France, Belgium and Spain. The intra-trade is higher than the extra-trade.

The main EU partners for export are USA, United Kingdom, China, Switzerland, Turkiye, Norway, Japan, and for import: China, USA, United Kingdom, Switzerland, Norway, Turkiye, Japan.

While main goods exported by the EU are machinery, other manufactured goods, chemicals, food and drink, energy and raw materials, the order of importance in case of imported goods is: energy, machinery and vehicles, other manufactured goods, chemicals, food and drinks etc. [11].

The share of exports in the EU GDP is higher than the share of imports reflecting an efficient international trade with a positive impact on GDP. If in 2013, the share of exports of all goods and services in GDP accounted for 45%, in the year 2022 it reached the highest share of 55.9%. Also, if in 2013, the share of imports in GDP was 41.5%, in 2022, it weighted for 54.4% [13, 14].

However, after a long period with a positive trade balance, the EU recorded a huge deficit in 2022 accounting for minus Euro 432 Million. This was due to the period of Covid-19 pandemic, the increased wave of imports starting since June 2021 when energy prices have begun to grow. While USA is the main trade partner for export, China is the main supplier of goods on the EU market [12].

In 2022, the EU contribution to the world trade was 13.7%, the lowest level in the decade 2013-2022, compared to 14.7% in 2021 and 16.1% in 2020 as a consequence of the negative factors influence mentioned above [15].

Agricultural industry is an important sector of the EU economy, as proved by agricultural production, income and prices and contribution to GDP. Despite that agricultural production increased also the related cost included in intermediary consumption went up for seeds, fertilizers, animal feeding stuffs, fuel for their tractors, veterinary services, energy etc. [22].

The economic accounts for agriculture showed that the EU agricultural output increased and gross value added as well both in crop and animal sectors. France, Italy, Germany, Spain, the Netherlands, Poland and Romania are the main contributors to the increase of agricultural production [16, 18, 19].

The main products which contribute to the development of the EU agri-food trade are: animal products: milk and dairy products [29, 37, 41, 45], pork and meat preparations [33, 36, 44, 45], and foodstuffs. Also, cereals, oils seeds and vegetables are important both for export and import [46].

EU is the largest exporter and importer of agri-food products at the global level, as the statistical data proved. The trade development was sustained by the growth in agricultural production grace to the CAP reforms which support the farmers to produce more and high

quality products to be competitive on the international market.

Sustainable agricultural competitiveness requires to take into account the economic aspect setting up the sustainable economic competitiveness index (*SECI*) with direct application for agri-food value chains [4] and this is required because of the large diversity of farms in profile, land use [40], labor (age, education, training level, farm experience), endowment, farms structure and size [32, 38, 39, 42, 43], productivity [34], standard output [47, 48], income [21].

However, the EU practices to import a part of agri-food products for covering the internal consumption. The assessment of the impact resulting from the EU's demand for food products, in terms of environmental and social indicators is very important, because this could led to environment degradation due to emissions, land use, employment and income [26].

In this context, the actual Green Deal has an important implication in the EU agri-food trade with the developing countries [27].

The promotion of the EU agri-food products has increased the opportunities to develop commercial transactions and enlarge the market segments and strengthen the relationships with the main trade partners: USA, China, Japan, Switzerland, Canada [2].

In this context, the aim of this study was to analyze the dynamics of the EU agri-food trade and highlight its efficiency by calculating specific indicators which could create an image about the EU performance in this economic field.

## MATERIALS AND METHODS

### Data collection

The paper is based on Eurostat Data base from where the empirical data have been extracted regarding the following indicators for the period 2013-2022: (i)Output value of agricultural industry, (ii)Export and import value of agro-food products, (iii)Share of agri-food export in total EU agro-food trade, (iv) Share of agri-food import in total EU agro-food trade; (v)Exported and imported quantities of agri-food products by the EU; (vi)Average export and import prices of agri-food products.

**Methodological aspects regarding the calculation of trade efficiency** determined in this study were:

(a)Total agri-food trade, T = E +I, where T = Total trade, E = Export value and I = Import value.

(b)The Coverage ratio, CR% = E/I * 100

(c)The trade-to GDP ratio, T-GDP% = T/GDP * 100

(d)Export ratio= ER% = EP/IP * 100, where EP = export price and IP = import price

(e)Net export or trade balance, NE, where: NE = E - I

(F)Share of export in the EU trade with agri-food products in the output value of agricultural industry, AO, E%= E/AO * 100.

Other statistical tools used in this study were:

-Growth rate of the studied indicators in the analyzed interval, $R\% = X_n / X_1 * 100$.

- Graphical illustrations were used for showing the dynamism of the studied indicators;

-Regression equations and $R^2$ for reflecting the trend line and the degree of determination of the changes of the considered variable.

- A part of the obtained results are presented in tables being accompanied by corresponding comments and graphics as well.

Finally, the main conclusions resulting from this study were drawn.

## RESULTS AND DISCUSSIONS

### Dynamics of Output Value in Agricultural Industry

In the EU has a strong and of high performance agricultural industry both in the field of vegetal and animal sector, as well as in services.

The implementation of various CAP reforms has a beneficial impact on output value.

In the last decade, 2013-2022, the agricultural output value (AOV) increased by 33.77% from Euro 398.5 Billion in 2013 to Euro 533.1 Billion in 2023. This was a consequence of the good results achieved both in the vegetal and animal sectors, where AOV raised by 33.19%, and, respectively, by 25.3%, in 2022 accounting for Euro 284.9

Billion in vegetal sector and for Euro 205.8 Billion in the animal field (Figure 1).

Therefore, the share of vegetal output in AOV increased from 535, the minimum level registered in 2014 to 55.3% recorded in the year 2021, but, in 2022, it decreased by 0.9 pp to 53.4%.

The share of animal sector registered a declining tendency from 41.8% in 2017, the lowest weight registered in 2013 to 36.2%, recorded in 2021, but, in 2022, it increased by 2.4 pp attaining 38.6%.

Also, subtracting the intermediary consumption from output value, the remaining gross value added (GVA), reflected a continuous ascending trend from Euro 166.2 Billion, the lowest value recorded in 2014 to Euro 219.5 Billion registered in 2022.

As a results, the share of GVA in AOV varied in the analyzed interval from 41.9%, the lowest weight in 2013 to 45.5% carried out in 2017.

However, after 2017, it was noticed a decline to 44.5% in 2018 and 2020, 42.3% in 2021 and 41.2% in 2022, as in the last years the intermediary consumption was affected by the higher price in farm inputs, especially for energy.

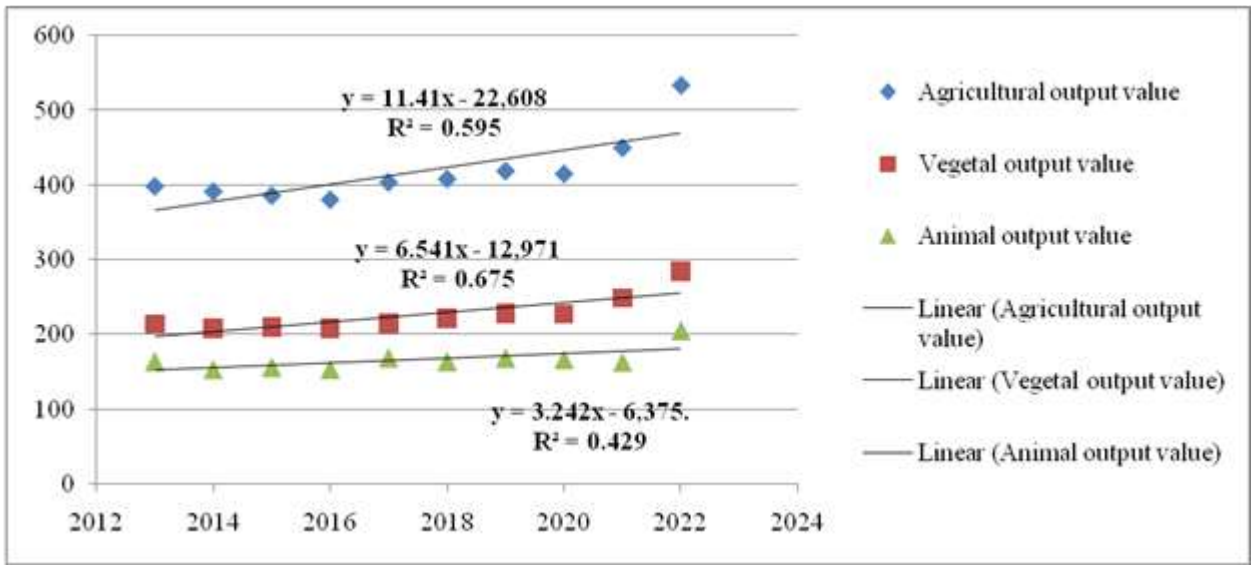


Fig.1. Dynamics of agricultural output value, of which in vegetal and animal sector, EU, 2013-2022 (Euro Billion)
Source: Own design and calculation based on the data from [8, 19].

The data from Figure 1 reflected that the highest share in AOV is kept by vegetal sector, where vegetables come on the top position, being followed by cereals.

On the second position is the animal sector, where the highest share belongs to milk subsector, followed by pig sector. On the 3rd position are the services for agriculture.

The increase in agricultural production value allowed the intensification of commercial exchange in the EU trade aiming to better cover the internal market needs and also to extend and strengthen its trade relationships at international level.

**Dynamics of the EU agri-food trade**

The EU trade value, including both export and import of agri-food products has remarkably grown by +61.3% from Euro 263.1 Billion in 2013 to Euro 424.6 Billion in 2022.

Export value has recorded an ascending trend from Euro 145 Billion in 2013 to Euro 229.1 Billion in 2022, which means a surplus of +58%.

At the same time, the value of agri-food import raised by 65.53% from Euro 118.1 Billion in 2013 to Euro 195.5 Billion in 2022 (Figure 2).

Having in mind the fact that the export value was higher than import value every year, the agri-food trade balance or net exports had positive values, which ranged between the minimum of Euro 25.6 Billion in 2015 to the peak of Euro 46.9 Billion in 2021.

In consequence, we may affirm that the EU trade with agri-food products is an efficient

one as net exports have positive values in the whole decade, reflecting that the EU is a net exporting community, a fact confirmed by the superunit values of the coverage ratio (export/import *100), which ranged between 119 in the year 2015 and 131, the peak achieved in the years 2020 and 2021. In 2022, the coverage ratio declined to 117 due to the increased prices for imports, especially caused by energy price (Table 1).

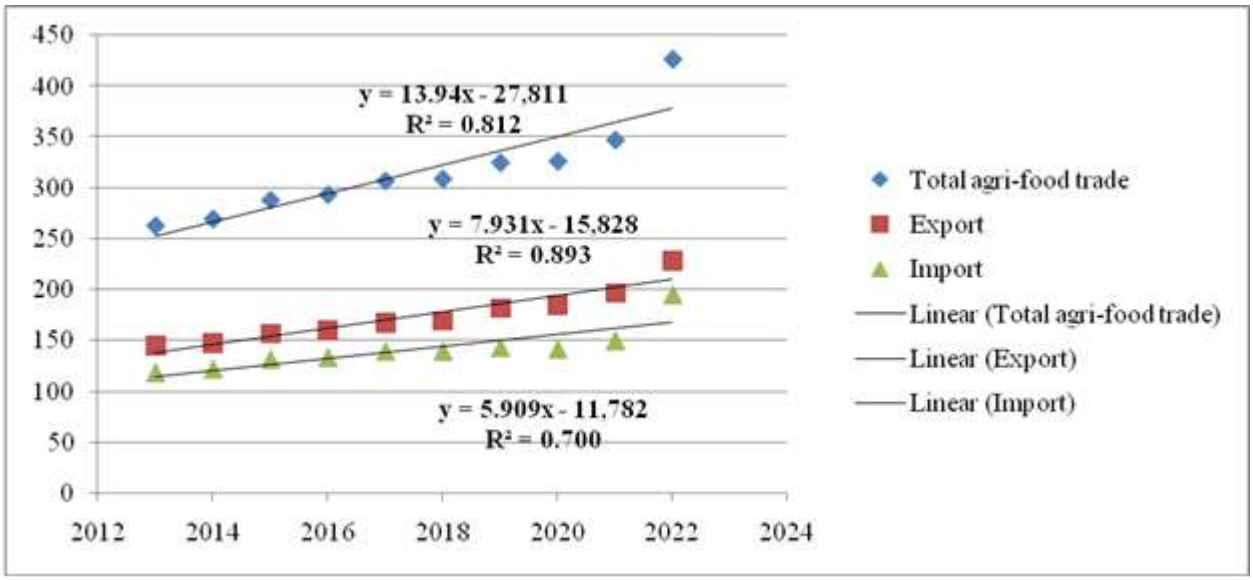


Fig. 2. Dynamics of EU agri-food total trade, export and import values, 2013-2022 (Euro Billion)
Source: Own design and calculation based on the data from [17].

Table 1. Dynamics of net export and coverage ratio of EU agri-food trade, 2013-2022

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| Net exports (Euro Billion) | 26.9 | 26.5 | 25.6 | 26.9 | 28.7 | 30.2 | 38.9 | 44.3 | 46.9 | 33.6 |
| Coverage ratio (%) | 122 | 121 | 119 | 120 | 121 | 122 | 127 | 131 | 131 | 117 |

Source: Own calculation based on the data from **[17].**

**Share of agri-food export and import in the EU trade**

Export and import of agri-food products has an important place in the EU trade, as proved by its increasing share in export from 8.15 in 2013 to 8.9% in 2021 and 2022, after a peak of 9.65% in 2020 and by its decreasing tendency of the agri-food import from 7.2% in 2013 to 7.1% in 2021 and 6.5% in 2022.

More than this, the weight of agri-food trade in the EU trade balance varied between 0.9% in 2013 and 2.4% in 2022, with the lowest share 0.3% in 2016 and 2017 and with the highest share of 2,4% in the last year of the analysis.

**The EU trade in terms of exported and imported amounts of agri-food products**

Both the amount of exported and imported agri-food products increased in the EU in the analyzed interval.

The exported quantities followed an ascending trend from 118 Million tons in 2013 to 136 Million tons in 2022, but the peak of 144 Million tons was carried in 2020. For the whole interval, the growth rate accounted for +15.26%.

In case of the imported amounts, it was also noticed an ascending trend from 120 Million tons in 2013 to 158 Million tons in 2022, meaning +31.66%.

However, the data set reflects that the exported amount exceeded the imported quantity till the year 2015. In 2016, the export and import was equal to 133 Million tons and since 2017, the imported quantities became higher than the exported ones, except the year 2021 (Figure 3).

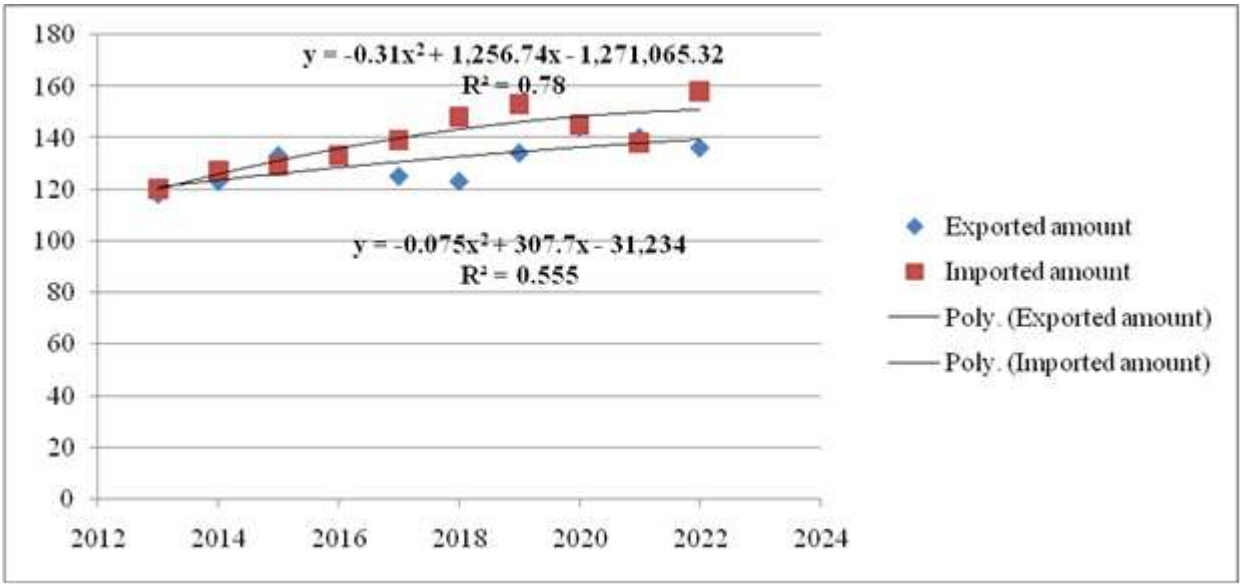


Fig. 3. Amounts of exported and imported agri-food products in the EU, 2013-2022 (Million tons)
Source: Own design and calculation based on the data from **[17].**

## Dynamics of the average export and import price for agri-food products

Average export price for the EU agri-food products was higher than the average import price in every year of the analyzed period.

The average export price increased from Euro 1,229 per ton in 2013 to Euro 1,684 in 2022, meaning by +37.13%.

The average import price also raised but by +25.71% from Euro 984 per ton in 2013 to Euro 1,237 in 2022 (Figure 4).

As a result the differences between export and import price had the highest value of Euro +447 per ton in the year 2022. The difference between export and import price in 2022 versus 2013 was +83.18% (Table 2).

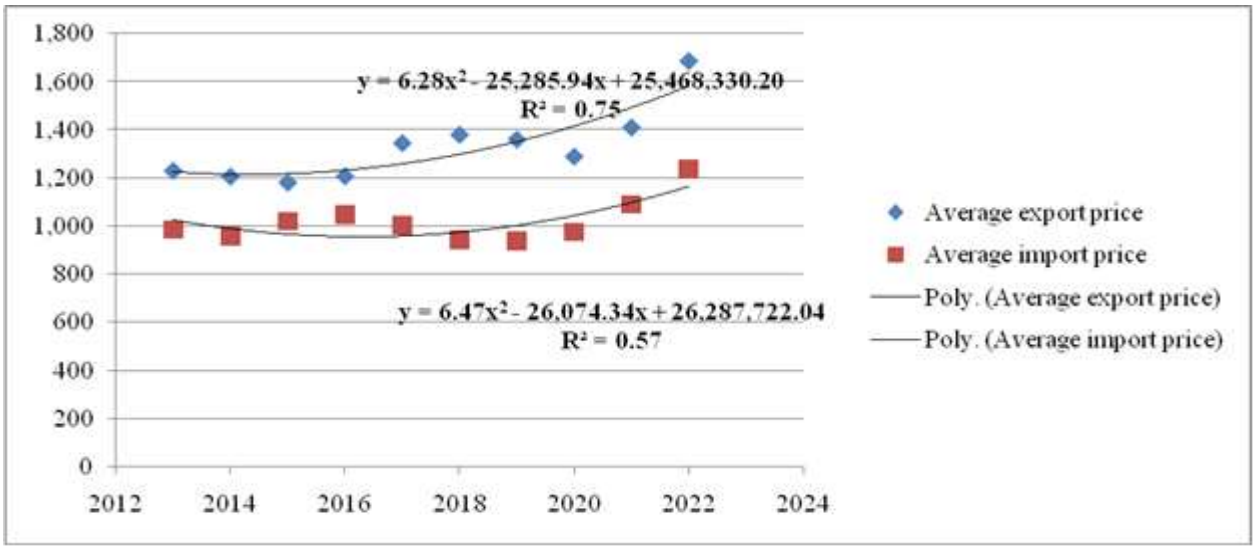


Fig. 4. Dynamics of average export and import prices for agri-food products in the EU, 2013-2022 (Euro/Ton)
Source: Own design and calculation based on the data from **[17].**

Table 2. Dynamics of the difference between average export and import price and Export ratio , 2013-2022

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| Price difference between export and import (Euro per Ton) | 26.9 | 26.5 | 25.6 | 26.9 | 28.7 | 30.2 | 38.9 | 44.3 | 46.9 | 33.6 |
| Export ratio (%) | 122 | 121 | 119 | 120 | 121 | 122 | 127 | 131 | 131 | 117 |

Source: Own calculation based on the data from **[17].**

Export ratio as the percentage of export price divided by import price was higher than 100, reflecting that the EU is a net exporting community. Its values varied between 115.09%, the lowest level, in2016 and 146.28% in 2018, the highest level.

**Share of export and import value by group of agri-food products in the year 2022 versus the year 2013**

The weight of a group of agri-food products in the export or import value reflects the importance of the group of products in the EU trade and also the ratio between production, as the main source of food products on the community market, and the imports required to better cover the population's requirements and assure food security. In case of export, in 2013, the rank of the four groups of products was: Foodstuffs, Vegetal products, Animal products and Fats and oils. In 2022, the hierarchy was: Foodstuffs, Animal products, Vegetal products, Fats and Oils.

In case of import, the EU proceeds to buy those products which it cannot produce or produce in a smaller amount or they have a lower price and more convenient instead of producing them in the community.

From this point of view, in 2013, the rank of the group of agri-food products was the following one: Foodstuffs, Vegetal products, Animal products and Fats and oils. In 2022, on the 1st position came Vegetal products, Food stuffs, Animal products and Fats and oils (Table 3).

Table 3. The share of export and import value by group of agri-food products in 2022 versus 2013 (%)

| | 2013 | | 2022 | | Difference 2022-2013 | |
|---|---|---|---|---|---|---|
| | Export | Import | Export | Import | Export | Import |
| Group 1- Animal products | 21.8 | 19.6 | 22 | 19 | +0.2 | -0.6 |
| Group 2. Vegetal products | 22.2 | 36.1 | 20 | 39 | -2.2 | +2.9 |
| Group 3. Fats and oils | 4.1 | 7.4 | 4 | 9 | -0.1 | +1.6 |
| Group 4. Foodstuffs | 51.9 | 36.8 | 54 | 32 | +2.1 | -4.8 |

Source: Own calculation based on the data from **[17].**

In case of Group 1, Animal products, export value of this type of products increased by 51.74% from Euro 31.5 Billion in 2013 to Euro 47.8 Billion in 2022, while import value went up by +59.91% from Euro 23.2 Billion in 2013 to Euro 37.1 Billion in 2022 (Figure 5).

Regarding Group 2, Vegetal products, export value increased from Euro 32.3 Billion in 2013 to Euro 47.3 Billion in 2022, meaning + 46.43%. the import value also increased, but by 83.33% from Euro 42.6 Billion in 2013 to Euro 78.1 Billion in 2022 (Figure 6).

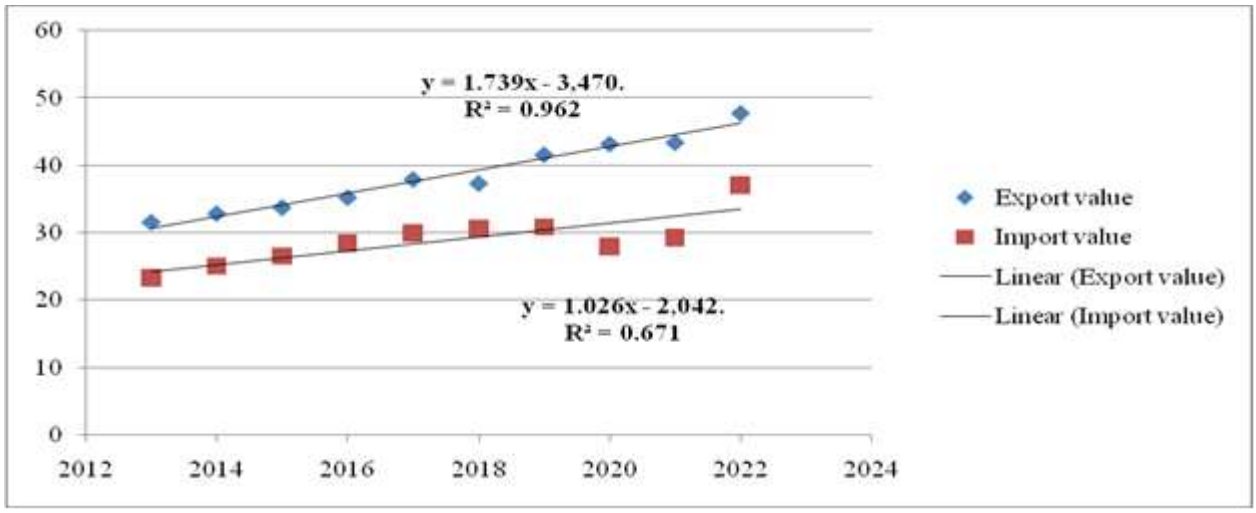


Fig. 5. Dynamics of export and import values for Group 1 Animal products, 2013-2022 ( Euro Billion )
Source: Own design and calculation based on the data from **[17].**

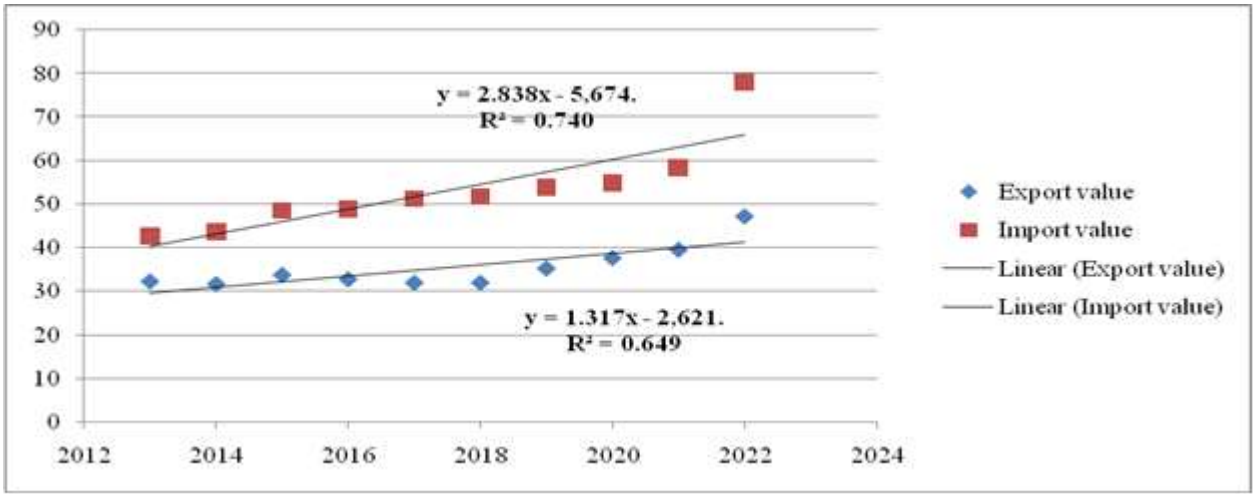


Fig. 6. Dynamics of export and import values for Group 2 Vegetal products, 2013-2022 ( Euro Billion )
Source: Own design and calculation based on the data from **[17].**

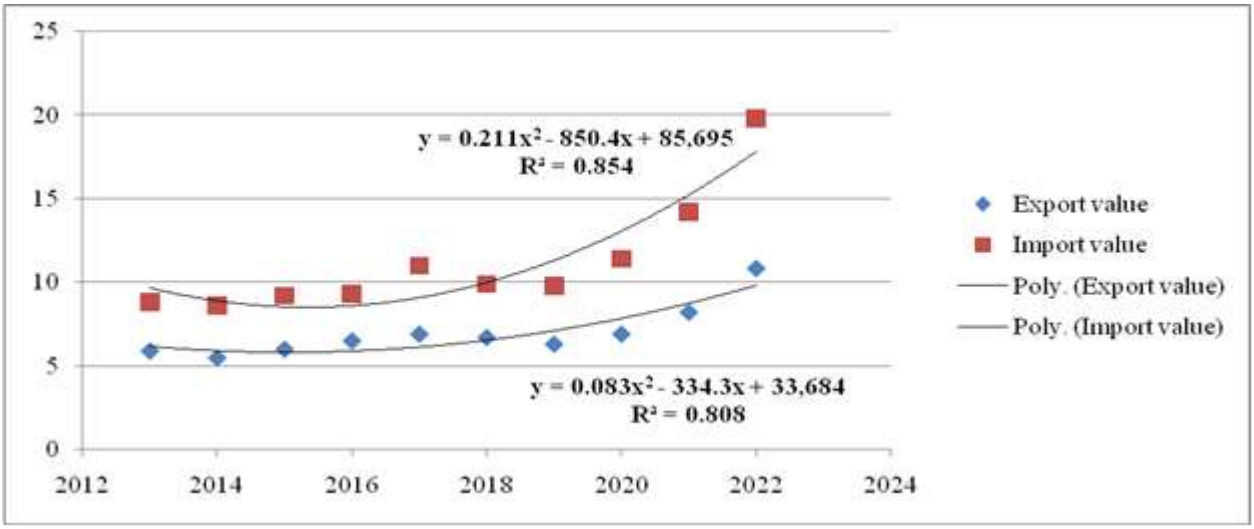


Fig. 7. Dynamics of export and import values for Group 3 Fats and oils, 2013-2022 ( Euro Billion )
Source: Own design and calculation based on the data from **[17].**

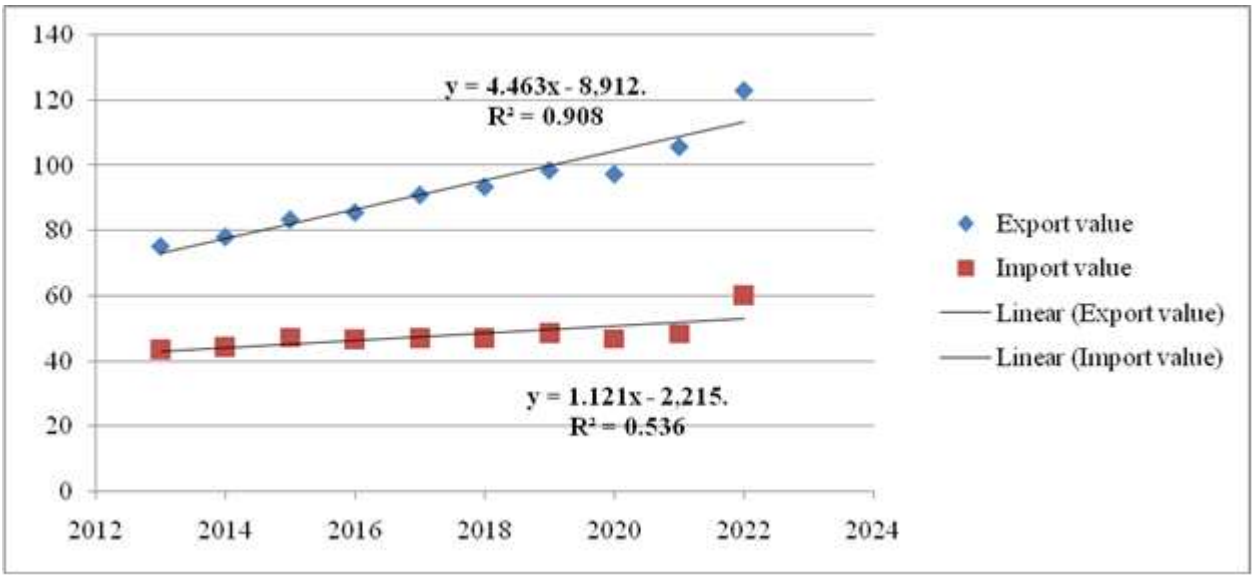


Fig. 8. Dynamics of export and import values for Group 4 Foodstuffs, 2013-2022 ( Euro Billion )
Source: Own design and calculation based on the data from **[17].**

Concerning Group 3. Fats and oils, the export value increased by 83.05% from Euro 5.9 Billion in 2013 to Euro 10.8 Billion in 2022, while the import value also raised but by 125%, from Euro 8.8 Billion in 2013 to 19.8 Billion in 2022 (Figure 7).

Finally, Group 4. Foodstuffs, the export value increased by 63.61% from Euro 75.3 Billion in 2013 to Euro 123.2 Billion in 2022, while the import value augmented by +38.85% from Euro 43.5 Billion to Euro 60.4 Billion in the analyzed interval (Figure 8).

In consequence, the trade balance by group of products was positive in case of Group 1. Animal products and Group 4. Food stuffs, and a negative one in case of Group 2 Vegetable products and Group 3 Fats and oils. Table 4 presents the results for Coverage ratio and Trade balance by group of products.

Table 4. Dynamics of the coverage ratio and trade balance by Group of agri-food products, 2013-2022

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Coverage ratio (%)** | | | | | | | | | | |
| Group 1 Animal products | 135.7 | 131.2 | 127.1 | 123.9 | 126.7 | 121.8 | 135.0 | 154.8 | 148.6 | 128.8 |
| Group 2 Vegetal products | 75.8 | 72.5 | 69.7 | 67.07 | 62.3 | 61.7 | 65.6 | 68.7 | 67.9 | 60.5 |
| Group 3 Fats and oils | 67.0 | 63.9 | 65.2 | 69.8 | 62.7 | 67.6 | 64.2 | 60.5 | 57.7 | 54.5 |
| Group 4 Food-stuffs | 173.1 | 176.5 | 176.9 | 183.5 | 193.8 | 198.7 | 203.1 | 207.8 | 218.8 | 203.9 |
| **Trade balance (Euro Billion)** | | | | | | | | | | |
| Group 1 Animal products | 8.3 | 7.7 | 7.2 | 6.8 | 8.0 | 6.7 | 10.8 | 15.2 | 14.2 | 10.6 |
| Group 2 Vegetal products | -10.3 | -12.0 | -14.7 | -16.0 | -19.3 | -19.8 | -18.5 | -17.1 | -18.7 | -30.8 |
| Group 3 Fats and oils | -2.9 | -3.1 | -3.2 | -2.8 | -4.1 | -3.2 | -3.5 | -4.6 | -6.0 | -9.0 |
| Group 4 Food-stuffs | 31.7 | 33.9 | 36.3 | 39.0 | 44.1 | 46.5 | 50.1 | 50.6 | 57.5 | 62.8 |

Source: Own calculation based on the data from [17].

**Share of agri-food export in the value of agricultural output**

It is also an indicator of efficiency both for agriculture and trade reflecting how much of agricultural output is available for being sold to other countries.

In Figure 9 it is shown the dynamics of export comparatively with the dynamics of agricultural output value.

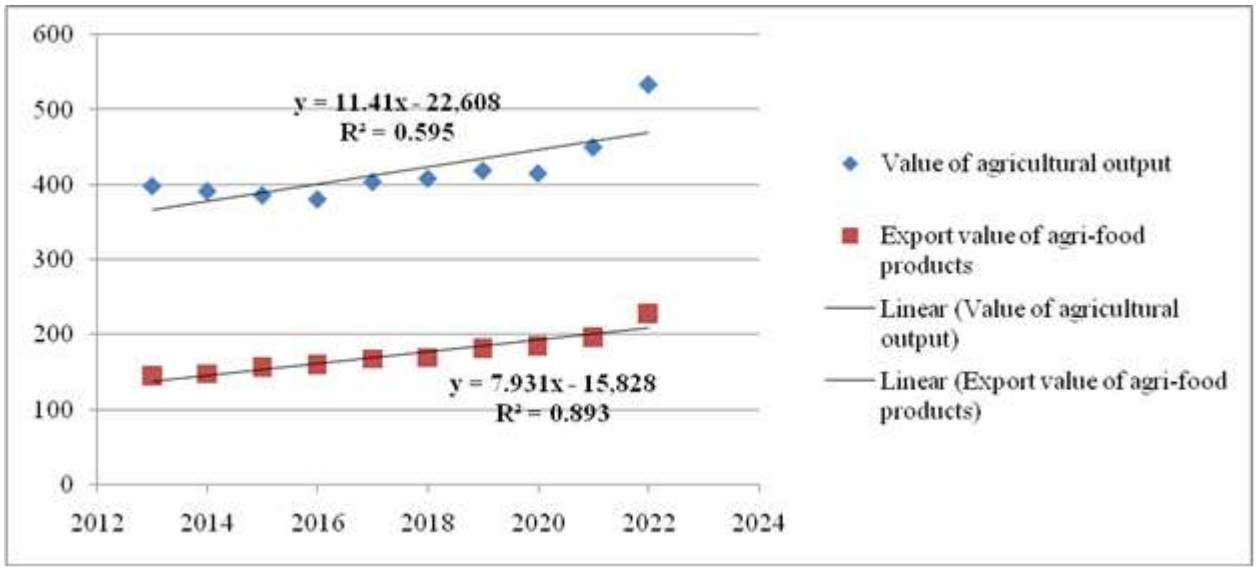


Fig. 9. Dynamics of export value of agri-food products and the value of agricultural output, 2013-2022 ( Euro Billion )

Source: Own design and calculation based on the data from **[17].**

In consequence, the weight of export value in agricultural output value ranged between 36.3% in the year 2013, the lowest level, and 44.6%, the highest level recorded in ten year

2018. In the year 2021, it was registered 43.8% and in 2022 42.9%, a much higher share than in the year 2013.

This means that the growth in agricultural production could increase the chance for sustaining the export of agri-food products and, implicitly, the position of the EU among the leaders in agri-food trade in the world.

Considering export value of agri-food products as the dependent variable Y and the value of agricultural output as the independent variable X, the correlation coefficient r = 0.926 and R square = 0.8586 reflected a strong and position link.

Table 5. Estimation of the regression model showing how the export value will depend on the agricultural output value

| Summary statistics | | | | | | |
|---|---|---|---|---|---|---|
| Multiple R | 0.92661833 | | | | | |
| R Square | 0.858621529 | | | | | |
| Adjusted R Square | 0.840949221 | | | | | |
| Standard Error | 10.13259179 | | | | | |
| Observations | 10 | | | | | |
| ANOVA | | | | | | |
| | df | SS | MS | F | Significance F | |
| Regression | 1 | 4988.266 | 4988.266 | 48.58570197 | 0.000116 | |
| Residual | 8 | 821.3553 | 102.6694 | | | |
| Total | 9 | 5809.621 | | | | |
| | | | | | | |
| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
| Intercept | -46.03742012 | 31.74841 | -1.45007 | 0.185085406 | -119.249 | 27.17455 |
| X Variable 1 | 0.525911093 | 0.07545 | 6.970344 | 0.000116028 | 0.351924 | 0.699899 |

Source: Own calculations.

This shows that the continuous growth of agricultural production could assure an increase in export of agri-food products.

Also, the determination coefficient $R^2 = 0.858$ shows that 85.8% of the variation of export value is caused by the variation in agricultural output value.

After applying the ANOVA, it was determined the regression equation Y = 0.5259 X - 46.0376.

The availability of the regression model is attested by F statistic value = 48.5857 which is superior to Significance F= 0.000116.

Lower 95% and Upper 95% show that the value of parameter "a" ranges between -119.249 < a < 27.174, and the value of parameter "b" varies between 0.351 < b < 0.639.

Therefore, we may consider that the meaning of the regression equation is the following one: for an increase by 1 Billion of agricultural output value, the value of agri-food export will increase by 0.52 Billion (Table 5).

## CONCLUSIONS

The EU has a high performance agriculture as reflected by the increasing trend of the value of agricultural output from Euro 398.5 Billion in 2013 to Euro 533.1 Billion in 2023, meaning a surplus on the whole decade of 33.77%. While the agricultural output in the vegetal sector farming raised by 33.19% , in animal sector is increased by 25.3%.

The EU total agri-food trade value went up from Euro 263.1 Billion in 2013 to Euro 424.6 Billion in 2022, which reflects a remarkably gain of +61.3% in the analyzed interval.

While the exported value of agri-food products had an ascending trend from Euro 145 Billion in 2013 to Euro 229.1 Billion in 2022, resulting a surplus of +58%, the value of agri-food import raised from Euro 118.1

Billion in 2013 to Euro 195.5 Billion in 2022, meaning by +65.53%

Net exports had a positive value in all the analyzed years, ranging between Euro 25.6 Billion in 2015 and Euro 46.9 Billion, the peak attained in 2021.

The coverage ratio was over 100% in all the studied years reflecting a high efficient agri-food trade.

The positive net exports and the superunit values of the coverage ratio, varying between 117 in 2022 and 131 in 2015, attest that the EU is a net exporting community.

The exported quantities of agri-food products exceeded the imported ones till 2015, while in 2016 they were equal, but starting from 2017, the imports exceeded the exports, except the year 2021.

Besides the relatively positive aspect regarding the amounts of exported products which were higher than the imported ones, the average export price was superior to the average import price in the analyzed period. Export price increased by 37.13%, from Euro 1,229 per ton in 2013 to Euro 1,684 in 2022, while import price went up by +25.71% from Euro 984 per ton in 2013 to Euro 1,237 in 2022.

As a result, export ratio was over 100 ranging between 119 in 2015, the lowest level and 131 in the years 2020 and 2021. In 2022, it had a fall to 117, but all the values show a high trade efficiency.

In the analyzed interval, there were noticed changes in the shares of the Groups of agri-food products in agri-food trade value. In 2022, in case of export, the hierarchy was: Foodstuffs, Animal products, Vegetal products, Fats and Oils, and in case of import: Vegetal products, Food stuffs, Animal products and Fats and oils.

While in 2022, the exports were higher in case of animal products and Foodstuffs, the imports declined.

Vegetal and Fats and oils diminished their share for export, and increased their weight for import.

In consequence, trade balance was positive and coverage ratio was over 100 in case of Group 1 Animal products and Group 4 Food stuffs. A negative trade balance and a coverage ratio below 100 was registered in case of Group 2 Vegetal products and Group 3 Fats and oils.

The share of agri-food export in agricultural output value ranged between 36.3% in 2013, and 44.6% in 2018. In 2021, it was 43.8% and in 2022 only 42.9%.

This reflects how important is the development of agricultural production to stimulate agri-food export.

The regression equation Y = 0.5259 X - 46.0376 expressing the dependence of export on agricultural production, could be interpreted that: an increase by Euro 1 Billion in agricultural output value could led to a growth in export value of Euro 0.52 Billion.

As a final conclusion, the analysis carried out in this research work highlighted the high efficiency in the agri-food trade of the EU in the period 2013-2022.

The CAP reforms oriented to a high performance from an economic, social, environment and food security point of view have to continue for strengthening the position of the EU as leader in the international trade with agri-food products.

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# CONCEPTUAL ASPECTS OF THE GROWTH OF AGRICULTURE PRODUCTION BASED ON THE IMPROVEMENT OF SCIENTIFIC SUPPORT

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***Abstract***

*The problems of ensuring food security and independence of the country in the current geopolitical situation and sanctions policy are of particular relevance. The purpose of this study is to develop conceptual aspects of the growth of production in the agro-industrial complex based on the improvement of scientific support. Theoretical and methodological approaches to improving the efficiency of institutional interaction between science, government, and business in the agro-industrial complex have been studied. An analysis was made of the share of domestic expenditures on research and development in the field of agricultural sciences in various countries. The main factors hindering innovation activity are systematized. An assessment of the volume and structure of financing of research work in the agro-industrial complex of Russia is given. The main directions of the concept of innovative development of agricultural products are formulated. The practical significance of the research results lies in the development of conceptual provisions for stimulating innovative production for the formation of an ecosystem of scientific support and commercialization of innovations in the agro-industrial complex.*

***Key words*****:** *innovations, institutional development, production, agro-industrial complex, efficiency, research costs, scientific support, trends, mechanisms*

## INTRODUCTION

Increasing the efficiency of agricultural production in the current geopolitical situation and sanctions policy is a driver for ensuring food security and state independence. The solution of these issues is inextricably linked with the development of the institutional structure of innovation activity, which provides the processes of generation, transfer, acceleration of innovations and science-intensive products into production processes to improve the quality of economic growth and solve the social problems of the rural population.

In accordance with the Strategy of Scientific and Technological Development of the Russian Federation [4], the problems of insufficient coordination of research institutions with sectors of the economy hinder the scientific and technological development of Russia. The insufficient degree of congruence of development institutions - science, the state, agribusiness and society, as well as the imbalance in the distribution of resources, knowledge, information, competencies and technologies at all stages of the innovation process hinders the formation of a well-functioning system of scientific support and commercialization of innovations in the agro-industrial complex.

Issues of interaction between science, government and business are widely reflected in foreign and domestic literature.

For the effective organization of the management of innovative production in agriculture, it is important to develop directions for its balanced development at the federal and regional levels based on the concept of national and regional

agroinnovative systems [7, 12]. In particular, D. Spielman defines an innovation system as a set of stakeholders in the innovation process, the interaction of which largely depends on the quality of socio-economic institutions that determine the formation of a fundamentally new model of relations between various participants, organizational cultures and behavior patterns. Using the example of agriculture in countries and territories of Africa located south of the Sahara, the author studied the problems of interaction between participants in production, the exchange and use of knowledge and information; susceptibility of stakeholders to technological, institutional and organizational transformations; the influence of political factors on the strengthening of these interactions and the growth of the welfare of the population [22].

The functioning of innovative systems is based on the principles of self-organization, so the possibility of full control over them is significantly limited; in the research environment, approaches to adaptive innovation management are becoming more common [8]. Relations between the participants of the agro-innovation system are transformed in accordance with the needs of industries and regions, they reach a certain balance in the course of their functioning [10]. As a result of this process, a number of participants can be excluded from the system of interactions [2, 23, 26]. The principles of functioning of agro-innovative systems include both traditional actions (support for research, formation of links between science, government, business, innovation formations), as well as measures aimed at creating an innovative infrastructure, eliminating the gap between existing and demanded digital competencies, and improving the regulatory framework. A significant contribution to the development of theoretical and methodological approaches to the formation of an agricultural knowledge and innovation system (AKIS) was made by N. Röling [17].

In foreign economic literature, one of the most popular concepts that integrate science, education and innovation into a single whole in order to develop and justify a national innovation policy is the “knowledge triangle” [24] (knowledge triangle.

The model of “open innovations” is also aimed at the development of cooperative ties between enterprises, universities and state scientific organizations [3],

The concept of the innovation spiral is widely used to study the development trends of the innovation process at all its stages. Thus, Ana Simonovska, Emelj Tuna, Dragan Gjoshevski applied this theoretical approach to identify the features of interaction between stakeholders in the process of introducing innovations in agriculture in North Macedonia [21] Using the results of focus group discussions, an assessment of the innovative potential of agriculture is presented and such key factors are identified technological development as policy, legislation, knowledge, innovation infrastructure, Education system in North Macedonia does not yet play a significant role in technology transfer; underfunding of the innovation process is to some extent due to the lack of foreign direct investment in the agricultural sector.

An important role is given to government grants, international programs to support innovation processes, in particular, the EU IPARD program on innovation and knowledge transfer. The authors also note the need to develop programs to support innovation in small-scale agriculture

The study of the processes of interaction between representatives of the system of agricultural research, development and knowledge-intensive activities, as well as advisory services and farmers, made it possible to assess the extent of the diffusion of innovations and the process of knowledge transfer in the agricultural sector. The conclusion is made about the need for close interaction of all participants in the innovation process. At the enterprise level, interactions with farmers' associations are important to support their networking activities; with experts and consultants to develop business plans; funding partners. For the effective implementation of the innovation spiral, the authors consider it necessary to increase the efficiency of interaction between stakeholders

at the stages of development and implementation.

In the work of the team of authors, I.S. Sandu, V.I. Nechaeva and N.E. Ryzhenkova analyzes the mechanisms for introducing innovations in the leading economies of the world; the authors note a number of important specific features of agriculture, such as the duration of the innovation cycle, the perception of innovations and the readiness to implement them; the role of the state both in supporting commercialization and mass introduction of agricultural innovations [16].

Also, based on the analysis of the conceptual aspects of the innovative development of the agro-industrial complex, the following approaches to innovative development have been identified: a cluster approach based on integration; creation of production and research and production systems based on cooperation; creation of sectoral innovation systems [19].

According to S.N. Polbitsyn, the innovative agricultural system is a network structure of interactions that arise in the process of food supply for the population. The agro-innovation system is presented as an evolutionary combination of the food supply system, the agro-industrial complex and the innovation system. The presented interpretations of the integrated forms of interaction between science, business, government and society do not take into account the specifics and scale at the regional and sectoral levels [13].

Summarizing domestic and foreign developments in the field of the formation and functioning of innovation systems, as well as the successful implementation of intellectual potential, we can state that it is necessary to create favorable conditions for voluntary cooperation of all stakeholders that form national innovation systems, such as the state, universities, scientific institutions, venture capital enterprises, enterprises of the real sector of the economy, etc. with obligatory consideration of the national specifics of the functioning of the economy.

The aim of the study is to develop conceptual aspects of production growth in the agro-industrial complex based on improving institutional interaction, as well as to study trends in the development of innovative processes based on improving scientific support.

## MATERIALS AND METHODS

The methodological basis of the study was state legislative acts, government decrees and decisions, scientific works of domestic and foreign scientists - economists and agricultural specialists on the problem under study.

In the course of the study, monographic, abstract-logical, analytical, economic-statistical, expert research methods were used. Legal and regulatory acts, information from Rosstat, National Research University Higher School of Economics, the Ministry of Agriculture of the Russian Federation, the Deloitte Research Center, as well as regulatory documents and materials from scientific literature and periodicals were used as the information base for the study.

## RESULTS AND DISCUSSIONS

The agro-industrial complex is a leading industry in Russia; in 2021, the volume of exports of agricultural products amounted to $37.7 billion, which in physical terms is more than 70 million tons [9].

Figure 1 shows the structure of exports by types of agro-industrial products in 2021.

According to Figure 1, it can be concluded that there is a high share of exports of grain, oil and fat products, fish and seafood.

Along with a fairly high level of exports, it is necessary to note the insufficient use of natural resource potential on the basis of efficiency-yield and productivity indicators [25].

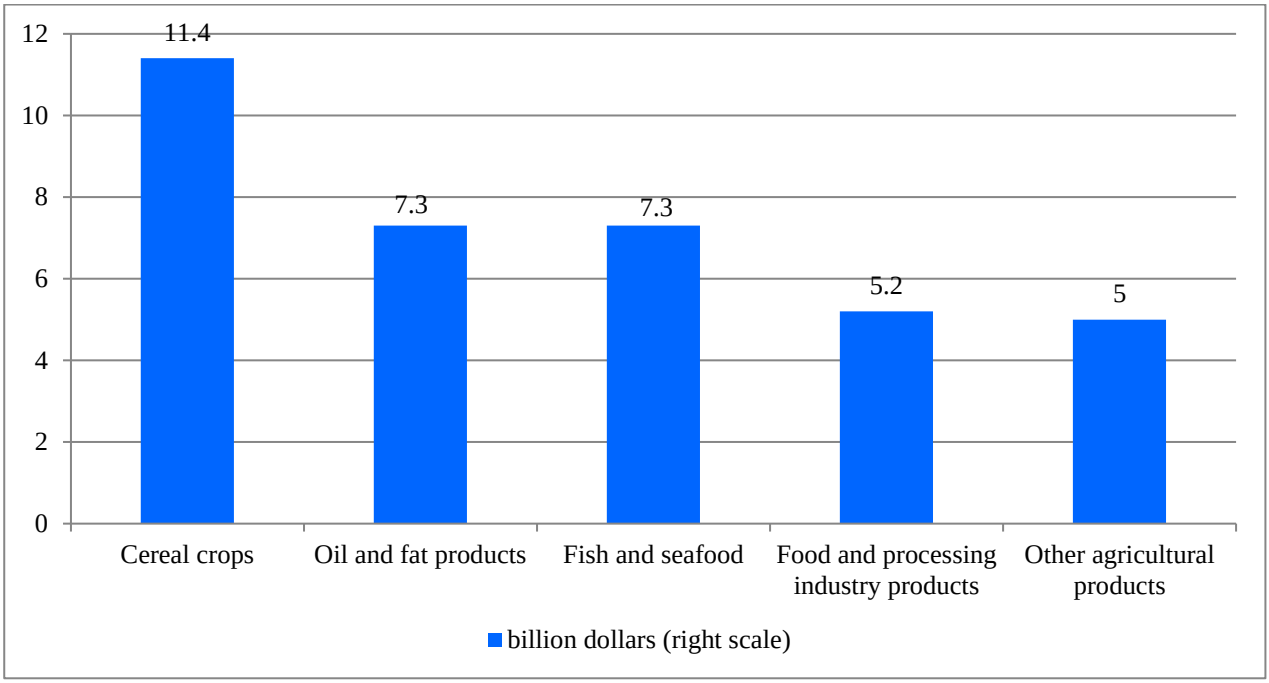


Fig. 1. Structure of exports by sectors of the agro-industrial complex in 2021
Source: Own calculations based on the data [18].

In Fig.2. shows the proportion of domestic R&D spending in the field of agricultural sciences in various countries in 2021. According to the Higher School of Economics, India occupies the largest share - 16.7%, Argentina - 11.4%, South Africa - 9.1%, the Netherlands - 8.7%, China - 7.9%. This indicator in Russia in 2021 is 4.4%, which is almost 3 times higher than in 2016, when it was 1.5%.

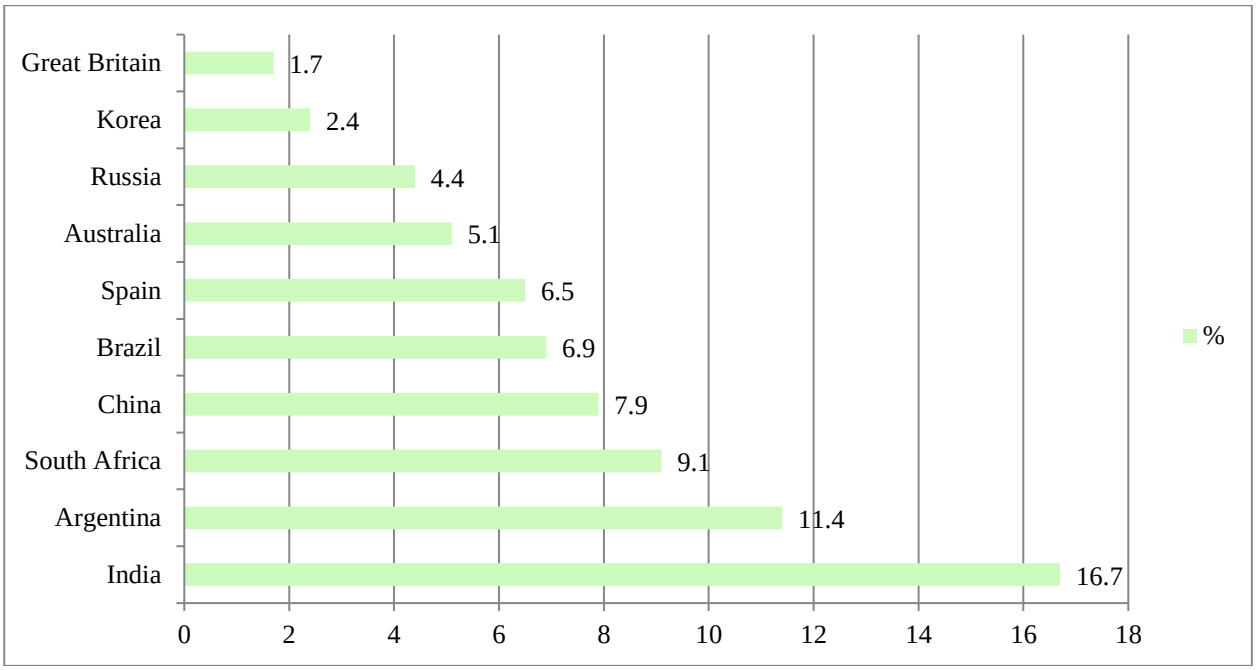


Fig. 2. Share of domestic spending on research and development in the field of agricultural sciences in the countries of the world in 2021, %
Source: Own calculations based on the data [20].

The paper analyzes and evaluates the main factors hindering innovation activity in Russia and some European countries.

Significant cross-country differences in the ranking of these factors by business representatives should be noted. Thus, in Russia, the most significant factor is the lack of own funds, which was noted by 10.6%, respectively. In Denmark, 32.4% of organizations identified a lack of credit or direct investment as the most important factor destabilizing innovation activity (Figure 3).

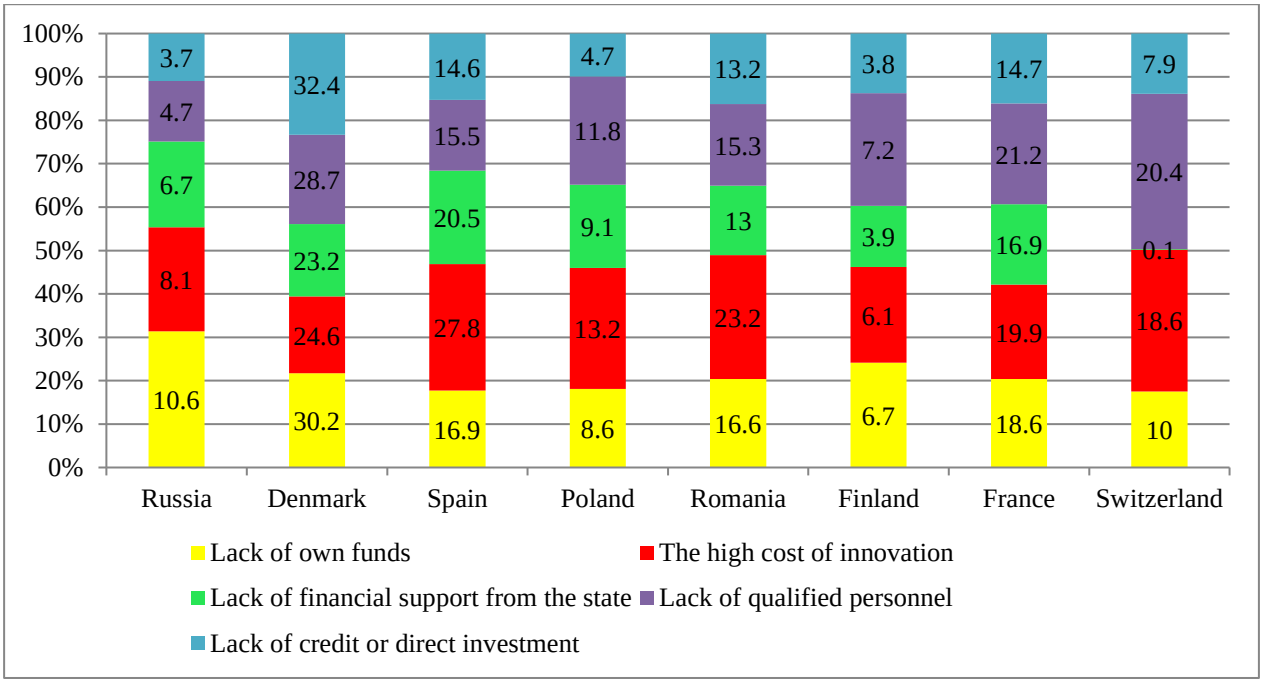


Fig. 3. The main factors hindering innovation activity by country (based on a sample statistical survey of organizations in 2018-2020), in % of the total number of organizations
Source: Own calculations based on the data [29].

It is noteworthy that the high cost of innovation is more emphasized by entrepreneurs in Spain (27.8%) and Romania (23.2%). In addition, businesses in Switzerland and Denmark have significant problems with qualified personnel, which was noted by 20.4% and 28.7% of organizations, respectively. Quantitative assessments of factors in Russia are to a certain extent comparable to those in Finland. In 2021, Finland is recognized as the second most innovative country in Europe, behind only Sweden. Finland's strengths lie in the use of information technology and intellectual assets, and key indicators include lifelong learning, patent applications and international scientific publications [6, 14,15].

In Russia, various mechanisms are used to stimulate and support the acceleration of innovative development of the agro-industrial complex. One of the effective measures is the support of start-ups [5]. An indicator of the priority of innovation activity in the economy is the volume of capital investment, and therefore it is important to monitor their dynamics. The volume of capital investments in agriculture, forestry, and fisheries in recent years from 2015-2021 increased by 130.1%, which to some extent compensated for the lack of foreign investment in the agricultural sector [27, 28]. An analysis of the volume of investment and financing of innovative activities in the agrarian sector of Russia showed that during the period under review there was an increase of about 200 billion rubles, which amounted to no more than 8%. The dominant role in the sources is the state budget. The reduction in funding was typical only in 2016 and 2021, in other periods there is a significant increase.

The financing of research work in the agro-industrial complex of Russia is shown in Figure 4.

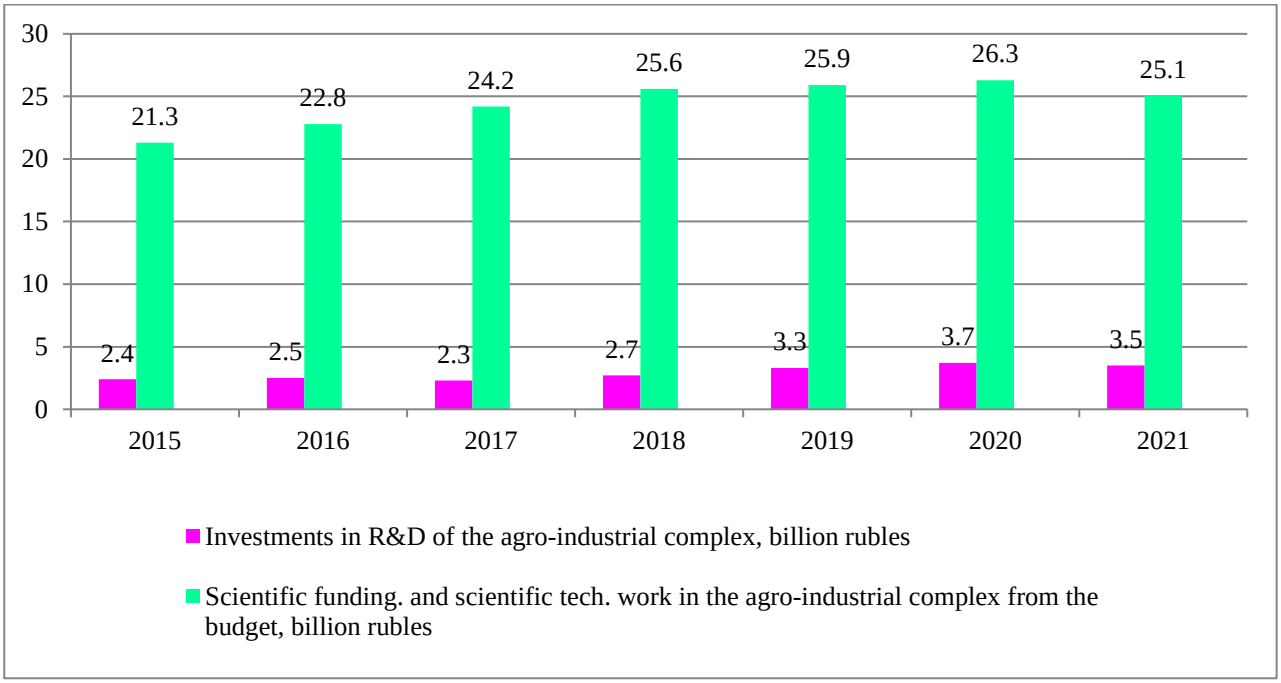


Fig. 4. Financing of research work in the agro-industrial complex of Russia, billion rubles
Source: Own calculations based on the data [1].

In the author's early works, the concept of innovative development of the agro-industrial complex until 2035 was proposed, aimed at increasing the production of agricultural products, improving their quality to the level of international standards and competitiveness in the foreign market [11]. The main directions of innovative development until 2035 are formulated for the economy and land relations, for the field of biotechnology, for innovative processes in crop production, animal husbandry, mechanization and electrification, for the storage and processing of agricultural products.

The implementation of the main provisions of the concept is aimed at stimulating innovation activity, developing rural areas, increasing technological, social, economic and environmental efficiency and affects the following aspects:

-transition to a knowledge economy in the agro-food complex based on digital transformation, increasing the key competencies of specialists and adapting them to modern conditions;

- building a system of scientific support and commercialization of innovations in the real sector of the economy;

-ensuring the optimization of the level of land use on the basis of an adaptive landscape basis

- increasing the sustainability of agricultural production based on the principles of public-private partnership.

## CONCLUSIONS

The paper explores theoretical and methodological approaches to improving the efficiency of institutional interaction between science, government, business in the agro-industrial complex. It is substantiated that as a result of this interaction, the processes of generation, transfer, acceleration of innovations and high-tech products into production processes are more effectively implemented. It was revealed that the functioning of network structures does not always take into account the specifics of agricultural production, taking into account regional and sectoral aspects. An analysis was made of the share of domestic expenditures on research and development in the field of agricultural sciences in various countries. Disproportions in financing in the main areas are revealed. The main factors hindering innovation activity in the EU countries are systematized. An assessment of the volume and structure of financing of research work in the agro-industrial complex of Russia is given. Conceptual provisions for regulating

the development of institutional interaction between science, the state, agribusiness and society have been developed in order to accelerate the introduction of innovations and scientific achievements into production. The practical significance of the research results lies in the development of conceptual provisions for stimulating innovative production based on the synergy of interaction between the state, universities, academic institutions, agribusiness, taking into account the needs for innovation in the context of industries and regions.

## ACKNOWLEDGEMENTS

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# ANALYSIS OF THE PERCEIVED ECONOMIC IMPACT OF AGRITOURISM ON FARMERS' LIVELIHOOD

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***Abstract***

*South African farmers' population is declining while those in business are struggling to remain economically viable due to the prevailing economic realities, which include the confluence of global market dynamics, and rising input costs that exert negative impact on the farmers' income. Agritourism is becoming an increasingly popular alternative form of agricultural enterprise development designed to expand farm income through better and more intensive utilization of existing farm resources. Three hundred questionnaires were distributed to selected farmers obtained from a population of 3,500 using Cochran's sample size formula. Multiple linear regression was used to analyze the relationships between the characteristics of the farmers' household and farm business as independent variables. Majority (70.9%) of farmers shows positive interest in offering agritourism because of its ability to stimulate local economic activities and the perceived economic benefits of increased revenues and farmer's livelihood. The study underscores the potential of agritourism justifying the urgent need to formulate valuable guidelines for the protection and development of the enterprise.*

***Key words*****:** *agritourism, global market dynamics, local economic growth, farm income, multiple linear regression*

## INTRODUCTION

South African farmers' population is declining while those in business are struggling to remain economically viable due to the prevailing economic realities, which include the confluence of global market dynamics, and rising input costs that exert negative impact on the farmers' income. Agritourism is becoming an increasingly popular alternative form of agricultural enterprise development designed to expand farm income through better and more intensive utilization of existing farm resources. It increases supplemental income and the diversity of agricultural products (Barbieri and Mshenga, 2008; Schilling *et al*., 2012; Tew and Barbieri, 2012) [6, 45, 54].

Agritourism is a form of tourism that emerged in the last century to become an increasily viable sector for the tourism industry worldwide (Sadowski and Wojcieszak, 2019) [42]. According to Nguyen, Suwanno and Thongma and Visuthismajam, (2018) [33], many studies has been carried out on the development of agritourism enterprises and its impacts in many parts of the world.

Most studies on agritourism were done in developed countries such as Australia, New Zealand, North America, and Europe (Barbieri and Mshenga, 2008; Schilling *et al*., 2012; Tew and Barbieri, 2012; Flanigan *et al*., 2014; Petrović *et al*., 2018) [6, 45, 56, 16, 37]. Limited research has been done in developing countries.

Viljoen and Tlabela (2006) [58] indicate that in South Africa, research regarding agritourism only gained significant attention within the last ten to fifteen years. The first agritourism activities to take place in South Africa were the ostrich farm in Oudtshoorn farm in the southern Cape and wildlife as game farms were added in the normal farming activities with the sole purpose of hunting (Grillin, Sacchi, Chase, Taylor, Van Zyl, Van der Merwe, Streifeneder and Fischer, 2022) [21]. The Cape wine route developed from three farms recorded fewer tourists in over 300 farms with up to 500,000 visitors per year. Saayman, Van der Merwe and Saayman, (2018) [41] found that agritourism is regarded as a important part of the agricultural

economy by 52.5% of farmers in the southern Cape Garden Route. Furthermore tourism activities recorded up to 30% of overall income for 60% of farming businesses (Saayman, *et al*., 2018)[41].

Although most of the farmers adopting agritourism looks for economic benefits of agritourism activities, the actual increase of revenues is not universal, rather it is specific to characteristics of the individual farms (Veeck *et al*., 2006) [57]. The regional effect influencing the revenues derived from agritourism are mostly economical successful agritourism operations generating revenues by offering multiple activities which are often located near other attractions (Saxena *et al*., 2007; Veeck *et al*., 2006; Fleischer and Tchetchik, 2005) [44, 57, 17]. Different farmers perceive the economic benefits of agritourism differently. For example, farmers with greater hectares of land may perceive agritourism as a convenient economic tool as these activities can alleviate management costs (Nickerson *et al*., 2001) [34]. The main purpose of the study is to analyze the perceived economic impact of agritourism on farmers' livelihood.

***Definitions of agritourism***

The term agritourism is often used instead of the term rural tourism to describe any form of tourism in rural areas (Demonja and Bacac, 2012)[14]. Definitions of agritourism are many in literature, reflecting the disagreement surrounding its meaning (Arroyo, Barbieri and Rich, 2012) [2]. According to Demonja and Bacac, (2012)[14], agritourism is an agricultural farm where the host family (owners of households) engage mainly in agriculture and dispose of extra living space and products in their farms which can be offered as tourist services.

According to Evans and Ilbery (1992) [15], tourism literature defines agritourism as the process of attracting tourist to the farm while sociology literature explain agritourism as one type of entrepreneurial venture developed to enhance farm revenue or value (Che, Veeck, and Veeck 2005, Barbieri and Mshenga 2008) [10][6]. Thus, the tourism perspective takes agritourism as a unique entrepreneurial venture while the sociological perspective views it as a component of the entire farm structure.

Arroyo, Barbieri and Rich, (2013) [2] highlighted the type of setting where agritourism activity occurs as a major discrepancy of agritourism definitions. Studies state that agritourism must be carried out on a farm (Carpio, Wohlgenant and Boonsaeng., 2008) [8]. The UC Small Farm Program (2012) narrate agritourism as a commercial enterprise at a working farm for the enjoyment of education of visitors that eventually generates supplemental income for the owner of the business.

***Importance of domestic tourism***

Tourism is important to the economy of South Africa (Robbins, 2017) [39]. The economic potential of tourism, as a catalyst for growth and development in South Africa, is based on the competitive advantages of the country's natural and cultural resources (Viljoen and Tlabela, 2006) [58]. Many of the tourism types such as eco, cultural and adventure tourism are ideally suited for developing tourism in rural localities with the necessary environmental qualities.

According to Mazimhaka (2007) [28] the development of domestic tourism can bring stability to a volatile industry and create a more sustainable path for tourism development. Robbins (2017) [39] found that in 2014, "1 in 25 individuals work in the tourism sector". The sustainability of tourism relies heavily on domestic tourism (Qin, Wall and Liu, 2011) [38]. According to Mustafa (2012) [32] domestic tourism has a significant contribution to the development of any nation, and it contributes to an improved balance of the national economy through a redistribution of the national income.

***Economic significance of agritourism in Mpumalanga Province***

Mpumalanga's tourism attractiveness lies in its diversity. Some of the features which make the country beautiful and incredibly attractive for tourism include accessible wildlife, varied and impressive scenery, unspoiled wilderness areas, diverse cultures (in particular traditional and township cultures) as well as a generally sunny and hot climate (Department of Finance, 2010)[12].

Tourism carries the potential to create opportunities for the entrepreneur and breed a unique informal sector. Tourism helps to save the environment and creates unique economic linkages with amongst others agriculture, light manufacturing (arts, crafts and souvenirs) and the services sector (health and beauty, entertainment and banking). Very importantly for South Africa, tourism creates decent work, is labour intensive and presents relatively low barriers to entry for entrepreneurs in terms of skills (Department of Finance, 2010) [12].

According to Busby and Rendle, (2000) [7] and Streifeneder, (2016) [53], the reason for farmers to adopt agritourism is the low agricultural income and the high income possibilities from tourism. Farmers are able to access extra income through farm diversification such as agritourism by delivering services to rural communities as well as to the society (Grillini, Sacchi, Chase, Taylor, Van Zyl, Van Der Merwe, Streifeneder and Fischer, 2022) [21].

***Job creation***

Tourism creates employment and through many activities are involved in travel. According to Msibi (2010) [30] tourism provides better opportunities, empowerment and security for the poor. Meyer and Meyer (2014) [29] point out that tourism plays a vital role in the employment creation process, particularly in developing countries. According to Keyser (2002) [23] entrepreneurs are aware that there is the potential to make money out of large numbers of people attending and visiting various tourism facilities and that tourism can increase the disposable income of people in local areas. Samini and Sadeghi (2011) [43] indicate that tourism creates employment opportunities, stimulates the growth of the tourism industry and triggers overall economic growth. Goods and services used by tourists are mostly labour intensive, leading to the creation of many jobs that are primarily low skilled (Adamou and Clerides 2007) [1].

The number of jobs created by tourism in many different areas is significant. These jobs are not only part of the tourism sector but may also include the agricultural sector, communication sector, health sector and the educational sector. Many tourists travel to experience the hosting destination's culture, different traditions and gastronomy. According to South African Tourism (2019) [50], Travel and Tourism accounted 1 in 4 of all new job created across the world. Figure 1 shows that tourism industry employed roughly 4.5% of the entire workforce in South Africa in 2018 (Grillini, *et al*., 2022) [21].

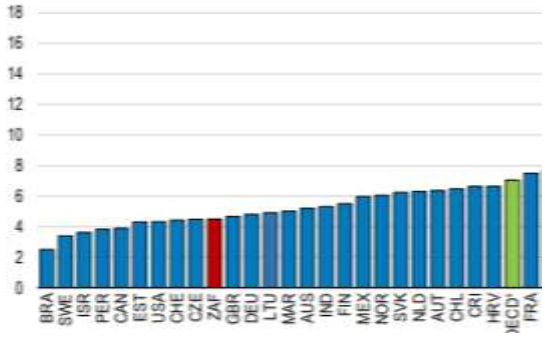


Fig. 1. Tourism employment is below the OECD average

Source: OECD Tourism Database [35].

The employment effect of a sustainable increase in the number of domestic as well as international tourists is therefore noticeable. For provincial economies to benefit most from employment opportunities created by tourists visiting the province, leakages to other provinces and the rest of the world should be minimised, and backward and forward linkages should be established within the boundaries of the province (Saayman, Saayman and Rhodes, 2001) [40].

***Earnings from tourism***

International tourism is often promoted in developing countries for its positive effect on the balance of payments and much-needed foreign exchange earnings (Williams and Shaw, 1992) [59]. One of the reasons for this is that the marketing of South Africa internationally is properly funded and organised by the South African Tourism Board, while the marketing of domestic tourism is undertaken by the nine provincial authorities (Saayman, Saayman and Rhodes, 2001) [40]. Meanwhile, in 2019 tourism recorded US$ 1.8 trillion (6.8% of the total exports) from the international visitor spending (Glocker and Haxton, 2020) [20].

Tourism is the third-largest sector in the world, contributing 10% of the world's GDP (Linderová, Scholz and Almeida, 2021) [27]. In 2021 the travel and tourism increased by US$ 1 trillion after the loss of almost US$4.9 trillion in 2020 (Glocker and Haxton, 2020) [20].

According to Statistics South Africa (2018) [51], tourism directly contributed 2.8% (2017) to the overall GDP of South Africa which is an increase of 1.8% (1995) and around 9% when taking into consideration the estimated indirect impacts (World Travel and Tourism Council, 2018) [60]. According to Statistics South Africa (2021) [52], tourism sector contributed R 130.1 billion to GDP which account roughly 3% of the total GDP [48]. The contribution of wine tourism to South Africa's GDP was R 2.4 billion in addition to 5.809 permanent employees and 4.414 casual employees during peak season (Back, Tasci, and Milman, 2020) [4]. While wine tourism remains an important segment of agritourism, many South African wine farms have added their tourist product offerings by developing services that enable them to compete (Back, Tasci, and Milman, 2020) [4].

Hunting tourism mostly trophy hunting contributed R 3.8 billion per annum to the country's economy, and created more than 17,000 job opportunities, thereby playing an important role in the country's rural tourism sector (Saayman, Van der Merwe and Saayman, 2018) [41].

The contribution of tourism to South Africa's economy is below the OECD average of 4.7% as compared to countries such as Sweden, the Czech Republic and Colombia.

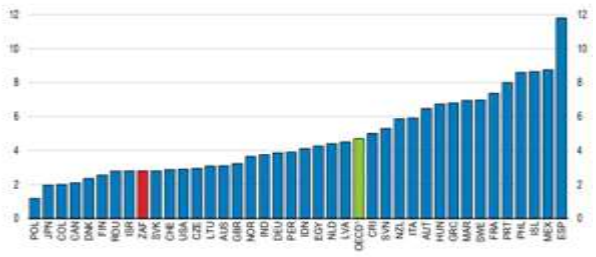

Fig. 2. Direct contribution of the tourism industry to the economy
Source: OECD Tourism database [35].

When South Africa is compared to other emerging countries such as India, Indonesia, Mexico and the Philippines, the contribution of the tourism sector to the economy is relatively small indicating the potential for a greater role as depicted in Figure 2 (Glocker and Haxton, 2020) [20].

***Domestic trips in South Africa***

According to South African Tourism (2012) [49], the total domestic trips undertaken in 2012, for VFR travel accounted for 72.3 percent, leisure travel 11.6 percent, religious travel 7.7 percent, business travel 6.7 percent and travel for medical purposes 0.5 percent (Figure 3). It is estimated that the volume of visit a friend and relative (VFR) account for 82 percent of domestic bednights which occurs outside the formal accommodation sector (South African Tourism, 2012) [49]. In South Africa the overwhelming majority of VFR tourism is an unpaid accommodation or the low income market segments in South Africa. For VFR tourist, the availability of friends and family is a key determinant of choice of domestic destination and length of stay; the most important activities are "socialising and family time, followed by shopping and opportunities to enjoy night life" (Mthente Research and Consulting Services, 2013) [31]. The growth of domestic tourism is a function of economic growth in the country (Henama and Sifolo, 2015) [22].

In both international and domestic tourism the second most important expenditure item is shopping, following accommodation (Turner and Reisinger, 2001) [55]. Although shopping is seldom mentioned as a primary reason for travel, it is perhaps the most universal of tourist activities, and of great economic importance to local merchants (South African Tourism, 2012) [49].

According to Chase, Stewart, Schilling, Smith and Walk, (2018) [9] agritourism is the core of on-farm experiences deeply connected to agricultural production. According to Kreag (2001) [25], tourist expectations can advance services, such as local shops, restaurants, and other commercial operators. Tourism products need to be unique to attract attention from tourists. Most tourism products offer experiences that cannot be duplicated and thus

attract customers utilizing relatively limited promotion (Keyser, 2002) [23]. Furthermore businesses must come up with innovative activities to prove the uniqueness of their products (Meyer and Meyer 2014) [29]. Innovation is important due to similar products and considerable competition in the tourism industry. For example, innovation includes product novelty through the introduction of fresh products and processes and the enhancement of exiting products (Meyer and Meyer 2014) [29]. Agritourism takes a different form that fall into five overlapping categories: direct sales of farm products, education, hospitality, outdoor recreation, and entertainment. Examples of direct sales on the farm includes tourist picking their own fruit as well as farm stands selling local products.

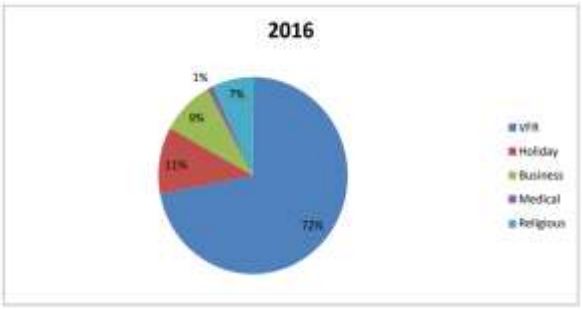


Fig. 3. Primary Purpose of Domestic Trips in SA (2016)
Source: TKZN, 2017 [51].

### *Agritourism products pricing*

Price is a measure by which industrial customers judge the value of an offering and it strongly impacts on brand selections among competing alternatives (Avlontis and Indounas, 2007) [3]. Furthermore, pricing is the only element of the marketing mix that brings in revenue for the farm business, while it is also the most flexible element of the mix because pricing decisions can be implemented relatively quickly.

The farms that are closely located to the CBD are highly priced than those located far afield (Lee and Jang, 2012) [26]. During high demand season proximity to the CBD allows hotels to enjoy a high room rate premium. In low demand season proximity to the CBD forces hotels to discount the room rates in consideration of the actions of adjacent properties (Lee and Jang, 2012) [26].

The setting of prices according to market demand and price sensitivity is very important. Lower prices are normally charged to price sensitive segments and higher prices to those segments that show a greater willingness and ability to pay (Forbes, Berthur and Sebastian, 2014) [18]. As a result farms are able to maximise revenues from the available capacity (Selmi, 2010) [46]. According to Christie and Crompton (2001) [11] pricing of hotel rooms is aggressive and both sophisticated and opportunistic. Each hotel room within the same hotel sells for a different price depending on its location, view and size. According to Mazimhaka (2006) [28], most developing countries' tourism is focused primarily on the international market and this has caused prices to increase beyond the affordability of most domestic tourists. In this context, the purpose of the paper is to analyze the perceived economic impact of agritourism on farmers' livelihood.

## MATERIALS AND METHODS

### Study design, study area and sampling

South Africa had nearly 96.34 million hectares of agricultural land in 2020, which corresponded to around 79 percent of the country's total land area. The Mpumalanga Province, is the second smallest of the nine provinces in South Africa, occupying almost half of the country's high potential arable land (Simpson, Badenhorst, Jewitt, Berchner and Davies, 2019) [47]. The population is predominantly rural with those living in rural areas depending entirely on land as the natural resource for farming and economic purposes.

The study was conducted in Ehlanzeni District municipality of Mpumalanga province (Figure 4). A purposive sampling technique was used to sample farmers who are linked to the Department of Agriculture, Rural Development, Environmental Affairs (DARDLEA).

Figure 1 shows the map of Mpumalanga province with its district municipalities (Demarcation Board, 2011) [13].


Fig. 4. Map of Mpumalanga Province with the District Municipalities.
Source: Demarcation Board, 2011, Data collection [13]

Data were collected in 2022 from a sample of **86 respondents** across the Mpumalanga province. A total of 300 questionnaires were distributed farm to the respondents and 29% of the respondents completed the questionnaires. Around 30% of the questionnaires were no usable to analyze the results while 41% of the respondents did not return the questionnaires citing that they are busy with the planting season and meetings. Using a pre-tested structured questionnaire. The questionnaire included three categories of socio-economic information, demographic characteristics (age, gender, level of education, employment status and annual turnover of the farm business and percentage of annual turnover from agritourism). Farm characteristics (employment from agritourism, Source of funding for the business, Source of information about agritourism, Willingness to participate in agritourism, perception about government support for agritourism). Farm visits were conducted for face-to-face interviews.

**Analytical model used in the study**

Descriptive statistics by way of frequencies to summarize the data using Statistical Package for the Social Sciences (SPSS). Multiple linear regressions were utilized to analyze the farm resources (independent variables) associated with the economic factors of the farm business and the farmer' turnover derived from agritourism activities (dependent variables). Independent variables included in the models were: farmer's location as descriptors of physical resources; operator's off-farm employment, level of education, agritourism contribution to the farmers income, farmers turnover received, source of information and type of ownership as indicators of managerial resources. Source of funding for the business, their willingness to participate in agritourism and whether the support from government is enough.

## RESULTS AND DISCUSSIONS

**Demographic characteristics of respondents**

From the data collected, 54.7% (47) were males and 45.3% (39) were females. A total of 31.4% of the respondents were aged between 31 to 45 years, followed by 29% aged between 46 to 59, 25.6% aged between 60 to 70years and 12.8% for ages between 18-30 to 60 years and lastly, 1.2% aged at 74 plus years. The demographic data seems to indicate that a greater percentage of the population in Mpumalanga province is young and energetic and below 50 years of age. The type of land tenure system for most respondents was inherited for 41.1%. The others 21.1% indicated their land were bought through government initiatives and 7.8% got their leasing while 6.7% "acquired permission to occupy"(PTO) from traditional leaders.

**Socio-Economic data analysis**

The socio-economic factors analysed included gender, age, employment status, level of education, annual turnover, percentage annual turnover from agritourism, been familiar with agritourism, employment through agritourism, source of funding, source of information about agritourism, willingness to participate in agritourism and perceived government support. The attributes listed in Table 1 had a potential in influencing economic impacts of Agritourism practice in Mpumalanga province. With the engagement of the local community in Agritourism, this may improve socio-economic status.

Farmers are likely to supplement their income supplying farm products and offer home stay services to tourists on their farms. In

Mpumalanga province, farmers make their living by having their farms diversified into several farming operations which agritourism is one of them. That has multiplier effect that impact on the entire community and country at large thereby improving livelihoods. Majority of the respondents (43%) indicated having attained only matric school level of education, 32.6% of the respondents had no formal learning and 9.3% obtained grade 11 while 12.8 obtained tertiary education (college education and above). The results shows that the literacy levels in Mpumalanga province are still low. Thein agreement with the government statistics that shows that in Mpumalanga province statement 10% of the provincial population is illiterate (Khuluvhe, 2022) [24]. Literacy is the ability to identify, understand, interpret, create, communicate, and compute, using printed and written materials associated with varying contexts (OECD, 2017) [35].

A larger proportion of households are practicing farming for a livelihood at 96.5 % as fulltime farmers, followed by 1.2% unemployed in a formal work environment, 2.3% employed as managers on behalf of private companies trading as agricultural business. The farmers that are familiar with the concept of Agritourism are 61.6%. Some of the reasons given why Mpumalanga province had a potential for Agritourism development included the strategic geographical positioning of the country such that tourists en route to the tourist attraction sites such as National Kruger Park and Panorama road pass through the province by road. There are other tourist attractions in the study area including Sudwala Curves which is located a few kilometers from the Nelspruit city center. The country has arable land suitable for farming activities and fresh water available from the Sabie River and several rivers traversing the province of Mpumalanga including Komati River making irrigation very feasible for farmers. Matsamo Cultural Village offers age-old folk songs, rhythmic dance performances, including the famous Rain Dance, music with authentic African instruments, as well as traditional Swazi cuisine. Tourists takes a tour through the village with its many huts and spaces, interacting with the villagers as they go about their daily activities such as cultivating their crops, preparing traditional food and fashioning beautiful craft.

Majority 72.1% (n=86) of the respondents are not practicing agritourism on their farms due to their business not catering for agritourism. Meanwhile 70.9% of the respondents are willing to venture into agritourism in order to take advantage of the additional income opportunities agritourism provides.

Even though agritourism is perceived to be catalyst for improving farmers' livelihoods, 33.7% of the respondents raised concern about government lack of support when it comes to agritourism in the country. any value addition and for those who did, 2.57% did Jams and 1.03% juices. The statistics indicates a gap which is an opportunity that can be exploited on various on-farms to promote growth of Agritourism and improve farmers' incomes.

The development of agritourism offers an important opportunity to South Africa to grow agritourism sector as route tourism is the best way to achieve sustainability in travel and tourism. Over a third (34.9%) of the agritourism farms and non-agritourism farms included in the study had an annual turnover of less than R30,000, another third (34.9%) had an annual turnover of R50,000–R100,000 and about 14.0% of the respondents earned a annual turnover of R30,000- R50,000 whereas 12.8% earned around R 100,000- R500,000, the last group earned 3.5% which is over R500,000 annual turnover. Simtowe (2010) [48], found that high-income earners can easily mobilize productive resources and are more diversified than low-income earners. However, Beyene (2008) [8] argues that the majority of farmers receiving off-farm income utilize their income for their consumption, while few farmers use the off-farm income to invest in their farms. Farms (82.2%) are operating from agriculture land that are mostly not far from towns. The proximity to towns suggests good accessibility to the farms, indicating superior access for tourists. variables included in the regression tests.

Table 1. The results show the profile of Mpumalanga province farmers who responded to the questionnaires

| Variable | Category | Frequency | % |
|---|---|---|---|
| Gender | Female | 39 | 45.3 |
| | Male | 47 | 54.7 |
| Which age group do you belong to? | 18-30yrs | 11 | 12.8 |
| | 31-45yrs | 26 | 31.4 |
| | 46-59yrs | 25 | 29 |
| | 60-70yrs | 22 | 25.6 |
| | 74+yrs | 2 | 1.2 |
| Employment status | Full time farmer | 83 | 96.5 |
| | Unemployed | 1 | 1.2 |
| | Manager | 2 | 2.3 |
| Level of education | None | 28 | 32.6 |
| | Grade 8 | 37 | 2.3 |
| | Grade 11 | 8 | 9.3 |
| | Matric | 3 | 43.0 |
| | M+3 | 8 | 9.3 |
| | M+4 | 2 | 3.5 |
| Annual turnover | Less than R30,000 | 30 | |
| | R30,000-R50,000 | 12 | 34.9 |
| | R50,000 – R100.000 | 30 | 14.0 |
| | R100,000 – R500,000 | 11 | 34.9 |
| | Over R500,000 | | 2.8 |
| | | 3 | 3.5 |
| % Annual turnover from agritourism | 0-5% | 62 | 72.1 |
| | 6-10% | 8 | 9.3 |
| | 10-20% | 6 | 7.0 |
| | 20-50% | 10 | 11.6 |
| Are you familiar with agritourism | Yes | 53 | 61.6 |
| | No | 33 | 38.4 |
| Employment through agritourism | 1-5 | 71 | 82.6 |
| | Greater than 5 | 9 | 17.4 |
| Employment of family members | 0 | 73 | 84.9 |
| | 1 | 3 | 3.5 |
| | 2 | 7 | 8.1 |
| | 3 | 2 | 2.3 |
| | More than 5 | 1 | 1.2 |
| Agritourism activities | None | 64 | 74.4 |
| | Accommodation | 4 | 4.7 |
| | Birding | 11 | 12.8 |
| | Farm stall | 7 | 8.1 |
| Source of funding for the business | Personal savings | 41 | 47.7 |
| | Loan | 17 | 19.8 |
| | Household money | 21 | 24.4 |
| | other | | 8.1 |
| Source of information about agritourism | Family/Friend | 5 | 5.8 |
| | Web search | 43 | 50.0 |
| | Agritourism service provider | 2 | 2.3 |
| | Route marketer | 1 | 1.2 |
| | Not aware | 34 | 39.5 |
| | Other | 1 | 1.2 |
| Willingness to participate in agritourism | Yes | 61 | 70.9 |
| | No | 25 | 29.1 |
| Do you perceive government support as enough? | Agree | 0 | 0 |
| | Neutral | 29 | 33.7 |
| | Disagree | 57 | 66.3 |

Source: author.

The operating age of the majority (41.2%) of the farms is more than 5 years and the number of full-time employees per farm was an average of three employees. Most of the owners (54.7%) were men and 45.3% are female. Farm owners (30.2%) are aged between 31 and 45 years and 43% of the respondents are having matric certificates. Almost fourth-quarters (96.5%) reported that farming is their main occupation. Most the farmers belonged to close corporative (61.8%) that get assistance from the government in terms of agricultural inputs. Tests revealed no collinearity issues among the independent

Half of the respondents (50%) received the information about agritourism through internet while 39.5% acquired the information through route markers, 1.2% from service providers and 1.2% of the respondents are not aware of agritourism. The findings are not consistent with the findings of Fotisa *et al*. (2012) [19] who found that recommendations about the destination from friends and relatives are the most trustworthy source of information used, closely followed by reviews and information provided by visitors on various websites and social media are regarded as trustworthy. The reason for the contradiction has to do with the fact that 43% of the respondents have matric and are familiar with technology. A similar finding was confirmed by Pabel and Prideaux (2016) [36], when they found that family and friends are the most widely used information sources regarding travel and tour, followed by previous experience at the destination.

**The regression analysis**

Below the correlation coefficient both the significance value of the correlation and the sample size (N) on which it is based are displayed Table 2. Each variable is perfectly correlated with itself (obviously) and so $r = 1$ along the diagonal of the table. The age of the farmer is positively related to the level of education of the farmer with a Pearson correlation coefficient of $r$=.290 and the significance value is less than 0.05 (as indicated by asterisk after the coefficient). The significance value of the study shows the probability of getting a correlation coefficient in the sample of farmers if the null hypothesis were true (there was no relationship between these variables) is very low (close to zero in

fact). Hence, there is a genuine relationship between age of the farmer and the level of education. The output shows that age of the farmer is positively related to the percentage of the annual turnover of agritourism, with a coefficient of $r$ = .232, which is also significant at $p$= .031. Finally, the question of whether the farmer is familiar with agritourism appears to be positively related to the level of education, $r$ = .326, $p$ = .002. The output shows that willingness to adopt agritourism is negatively related to the level of education of the farmer, with a coefficient of $r$ = -.386, which is significant at $p$< .001. The willingness to adopt agritourism by the farmer appears to be negatively related to the level of education of the farmer, $r$ = -.455, p < .001. Finally, the level of education of the farmer appears to be positively related to the annual turnover agritourism of the farmer, $r$ = .546, $p$< .001 as depicted in Table 2.

Table 2. Correlation analysis output

| **Correlations** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Age | Annual turnover | Familiar with agritourism | Wiligness adpting agritourism | Education level | %Annual turnover from agritourism |
| Age | Pearson correlation | 1 | .081 | .037 | -.128 | .290 | .232* |
| | Sig. (2-Tailed) | | .458 | .738 | .239 | .007 | .031 |
| | N | 86 | 86 | 86 | 86 | 86 | 86 |
| Annual Turnover | Pearson correlation | .081 | 1 | .079 | -.130 | .056 | .076 |
| | Sig. (2-Tailed) | .458 | | .470 | .233 | .606 | .489 |
| | N | 86 | 86 | 86 | 86 | 86 | 86 |
| Familiar with agribusiness | Pearson correlation | .037 | .079 | 1 | -.189 | .326** | .211 |
| | Sig. (2-Tailed) | .738 | .470 | | .081 | .002 | .051 |
| | N | 86 | 86 | 86 | 86 | 86 | 86 |
| Willigness adopting agritourism | Pearson correlation | -.128 | -.130 | -.189 | 1 | -.386** | -.455 |
| | Sig. (2-Tailed) | .239 | .233 | .081 | | <.001 | <.001 |
| | N | 86 | 86 | 86 | 86 | 86 | 86 |
| Education level | Pearson correlation | .290** | .056 | .326** | -.386** | 1 | .456** |
| | Sig. (2-Tailed) | .007 | .606 | .002 | <.001 | | <.001 |
| | N | 86 | 86 | 86 | 86 | 86 | 86 |
| % Annual turnover from agritourism | Pearson correlation | .232* | .076 | .211 | -.455** | .456** | 1 |
| | Sig. (2-Tailed) | .031 | .489 | .051 | <.001 | <.001 | |
| | N | 86 | 86 | 86 | 86 | 86 | 86 |
| **Correlation is significant at 0.01 (2-tailed)<br>* Correlation is significant at 0.05 level (2-tailed). | | | | | | | |

Source: Author's results.

## CONCLUSIONS

The tourism sector contributes significantly in the economic growth of the Mpumalanga province particularly in terms of revenue, GDP, employment creation and economic growth. Mpumalanga province is a popular tourist destination due to the whole range of natural beauties, including traditional cultural heritage which plays a vital role in the further development of the tourism industry.

Findings about gender, education level and annual turnover of farmers can all be useful in assessing the potential for successful agritourism program design. For example, the level of education and their willingness to diversify their farms through agritourism can encourage other farmers to establish agritourism in order to increase their farm turnover.

The results revealed a very small proportion of farmers adopted in agritourism in Mpumalanga province. Majority (70.9%) of farmers shows positive interest in offering agritourism because of its ability to stimulate local economic activities and the perceived economic benefits of additional revenues and farmer's livelihood.

Results also support agritourism as not being greatly important for providing employment for family members (Barbieri and Mahoney, 2009) [5], a result that was not expected considering the desires of farmers to maintain their rural and agricultural lifestyle for themselves and family.

The study underscores the potential of agritourism justifying the urgent need to formulate valuable guidelines for the protection and development of the enterprise.

About 66.3% of the respondents disagree with the statement that says government support for agritourism is enough.

The respondents ascertain that the state of the agritourism in the province is not at the level it should and there are challenges that must be addressed for progress to be realized in terms of agritourism.

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# DIGITAL TEACHING BEHAVIORS IN 2020-2022 IN PRE-UNIVERSITY INSTITUTIONS FROM URBAN AND RURAL AREAS

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***Abstract***

*Due to the changes that the pandemic imposed on the educational system, three periods can be identified in Romania, depending on the teaching methods used: Online teaching - 2020; Hybrid teaching - 2021; Traditional teaching (in physical format) - 2022. In each of these periods, teachers had to adapt their teaching style and use specific digital tools and applications. In this paper, we present the research conducted as part of doctoral theses in 7 pre-university institutions (2 high schools from urban environments and 5 secondary schools from rural environments), where questionnaires were collected from 100 teachers. The results revealed differences in the way of approach to teaching in the three analyzed periods, with a pronounced traditional behavior in the rural environment and with an obvious reluctance to change.*

***Key words*****:** *urban and rural education, teaching behaviour, digital tools, digital applications*

## INTRODUCTION

In 2020, during the pandemic, it became clear that traditional teaching often does not match the innovative model of online education, but also that teachers need experiences that integrate digital technologies into learning and technical training in the use of digital tools [11]. Some studies have shown that in just a few months, skills in using digital technologies for instruction have improved and confidence in using technology for instruction, assessment, feedback, and communication has increased [2] access to technology and many challenges (economic and social), especially in 2020 [8, 9, 3], and a lack of support for remedial programs in 2021, which was reflected in students' poor grades [7].

From 2021, schools gradually tried to return to normality, and the various forms of hybrid teaching were replaced by traditional teaching. De Souza Júnior et al [4] pointed out that there are some factors that could influence the incorporation of digital technology in traditional education in the future: "1) the teaching concept, 2) the belief in digital technology as a way to relate to physical education, and 3) the pedagogical time for planning". Other authors believe that we need to integrate digital technologies into the classroom to improve the quality of knowledge transfer [12] or to increase student engagement and motivation [6].

We must understand that in recent years the whole society has undergone major transformations that required interventions and political initiatives to respond to the challenges. As a response to these challenges was developed at European level the “Digital Education Action Plan” [5] and in the field emerged the concept of Education 4.0 like a new educational paradigm. However, to implement all these new ideas and concepts many countries need investments in ICT infrastructure, in the development of digital skills and the promotion of an adapted curricula. In Romania for example, many authors and stakeholders consider that the promotion of this technology-oriented approach is not yet possible [10].

There are many reasons, known since the pandemic period, why it is so difficult to transform the Romanian educational system: the great differences between urban and rural areas, the inadequate infrastructure both at the level of schools and at the level of the Internet network, etc.

These inadequacies, dating back to the past years, have always been a focus of educational reform strategies.

It is believed that as long as solutions to the current structural problems are not found, the only way forward is to introduce various elements of digitization within the system.

In addition, many teachers are still reluctant to introduce digitization into their jobs, preferring to return to the way they taught before the pandemic.

They are unwilling to continue using what ICT tools they have acquired in recent years. One might ask why this is, but we believe the correct question is:

Did teachers use digitized teaching methods during the pandemic, or did they simply use technology to help them implement teaching methods specific to traditional teaching? Therefore, we believe that this research, conducted at the level of teachers from different residences and educational levels, can give us an answer to this question and show their behavior in the period 2020-2022.

## MATERIALS AND METHODS

In 2022, we carried out a survey based on a questionnaire among the teaching staff in pre-university education. The survey was conducted in two high schools from urban areas (Gh. Cherchez Technological College Ion Ghica Theoretical High School from Racari) and five schools from rural areas (Slobozia Moara Secondary School, Cotesti – Godeni Secondary School, Tartasesti General School, Lunguletu School No. 2. Serdanu General School). We collected 100 questionnaires from 47 teachers from urban areas and 53 teachers from rural areas. The main objective of the questionnaire was to investigate how they integrated technology into the teaching process in the period 2020-2022.

The questionnaire was structured on multiple sections (with 37 questions) focused on the following periods: online education – 2020; hybrid education – 2021; physical education – 2022. The results were processed with IBM SPSS Statistics software.

The main characteristics of the respondents are presented in Table 1.

Table 1.The main characteristics of respondents by residential environments

| Variable | Labels | Urban | | Rural | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Frequency | Percent |
| Seniority in education | Under 5 years | 8 | 17.0 | 3 | 5.7 |
| | 5-9 years | 8 | 17.0 | 12 | 22.6 |
| | 10-14 years | 10 | 21.3 | 12 | 22.6 |
| | 15-19 years | 8 | 17.0 | 12 | 22.6 |
| | Over 20 years | 13 | 27.7 | 14 | 26.4 |
| Seniority in school | Under 5 years | 20 | 42.6 | 11 | 20.8 |
| | 5-9 years | 9 | 19.1 | 16 | 30.2 |
| | 10-14 years | 11 | 23.4 | 8 | 15.1 |
| | 15-19 years | 3 | 6.4 | 5 | 9.4 |
| | Over 20 years | 4 | 8.5 | 13 | 24.5 |
| Holder | Yes | 31 | 66.0 | 41 | 77.4 |
| Age | Under 29 years | 5 | 10.6 | 1 | 1.9 |
| | 30-39 years | 15 | 31.9 | 20 | 37.7 |
| | 40-4 years | 16 | 34.0 | 20 | 37.7 |
| | 50-59 years | 9 | 19.1 | 10 | 18.9 |
| | Over 60 years | 2 | 4.2 | 2 | 3.8 |
| Educational level | Primary education (grades 0 – 4) | 8 | 17.0 | 18.0 | 34.0 |
| | Secondary education (grades 5 – 8) | 10 | 21.3 | 34 | 66.0 |
| | High school education (grades 9 – 12) | 29 | 61.7 | - | - |
| **Total** | | **47** | **100,0** | **53** | **100,0** |

Source: Own determinations.

From Table 1, we may easily notice that:
-47 respondents from urban areas; 66% are holders; 34% have under 10 years in education and almost 62% have under 10 years in their school;
-almost 62% are teaching in high schools;
-53 respondents from rural areas;
-77.4% are holders;
-around 28% have under 10 years in education and almost 62% have under 10 years in their school;
-66% are teaching in secondary schools and 34% in primary schools.

## RESULTS AND DISCUSSIONS

During the pandemic period, when all educational systems implemented online teaching, there were two main platforms (videoconferencing services) used by Romanian teachers: Google Meet (55%) and Zoom (32-38%) (Table 2). The main tool for class management was also from Google, with a 66% share in urban areas and 92.5% in rural schools.
In 2020, there were many sources of digital resources. Two of them were already established at the institutional level, namely Scoalapenet.ro and Edu.ro. Our data show that the latter website was more used by rural teachers (almost 70%), along with their own sources posted in Google Classrooms (13.2%). Urban teachers' preferences were distributed between these two websites (about 40-45% each).

Table 2. The teaching behavior of teachers during the online education period (2020-2021), by residential environments

| Variable | Labels | Urban | | Rural | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Frequency | Percent |
| Main platform for online classes | Google Meet | 26 | 55.3 | 29 | 54.7 |
| | Zoom | 18 | 38.3 | 17 | 32.1 |
| The main platform for classroom management | Google classroom | 31 | 66.0 | 49 | 92.5 |
| The platform for access to digital resources and for creating teaching materials | Scoalapenet.ro (School on the internet) | 19 | 40.4 | 3 | 5.7 |
| | Edu.ro EDU Network | 21 | 44.7 | 37 | 69.8 |
| | Google Classroom | 2 | 4.3 | 7 | 13.2 |
| Course manual type (Multiple variable) | Pdf | 42 | 40.0 | 28 | 23.7 |
| | Word | 22 | 21.0 | 33 | 28.0 |
| | YouTube | 23 | 21.9 | 37 | 31.4 |
| Apps for teaching (Multiple variable) | Microsoft Office | 35 | 35.0 | 34 | 29.8 |
| | Gmail | 23 | 23.0 | 13 | 11.4 |
| | Google Forms | 14 | 14.0 | 15 | 13.2 |
| | Google Docs | 6 | 6.0 | 16 | 14.0 |
| | Jam board | 2 | 2.0 | 13 | 11.4 |
| Devices (Multiple variable) | Laptop | 45 | 55.6 | 50 | 53.8 |
| | Phone | 32 | 39.5 | 40 | 43.8 |
| Apps for communication (Multiple variable) | WhatsApp | 32 | 38.1 | 46 | 52.3 |
| | Email | 27 | 32.1 | 18 | 20.5 |
| | Google Classroom | 23 | 27.4 | 22 | 25.0 |
| Access of the students to information (Multiple variable) | During online classes | 30 | 36.1 | 43 | 39.8 |
| | Email or WhatsApp | 23 | 27.7 | 34 | 31.5 |
| | Google Classroom | 28 | 33.7 | 28 | 25.9 |
| Main teaching methods (Multiple variable) | Explanation | 47 | 28.3 | 53 | 29.9 |
| | Online games | 31 | 18.7 | 24 | 13.6 |
| | You Tube movies | 21 | 12.7 | 38 | 21.5 |
| | Collaborative online project | 16 | 9.6 | 7 | 4.0 |
| | Websites | 11 | 6.6 | 16 | 9.0 |
| Evaluation type (Multiple variable) | Online - oral | 45 | 40.2 | 46 | 37.7 |
| | Online - Online - written, by showing answers to the camera or pictures | 39 | 34.8 | 35 | 28.7 |
| | Google Forms | 22 | 19.6 | 35 | 28.7 |

Source: Own determinations.

In urban schools, the didactic support for classes were in pdf (405) or word format (21%), but some teachers used also You Tube films (22%).

Table 3. The teaching behavior of teachers during the online education period (2021-2022), by residential environments

| Variable | Labels | Urban | | Rural | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Frequency | Percent |
| Main platform for online classes | Google Meet | 27 | 54.0 | 33 | 48.5 |
| | Zoom | 21 | 42.0 | 16 | 23.5 |
| | Teams | 2 | 4.0 | 19 | 27.9 |
| The main platform for classroom management | Google classroom | 42 | 89.4 | 52 | 98.1 |
| The platform for access to digital resources and for creating teaching materials | Scoalapenet.ro (School on the internet) | 18 | 38.3 | 3 | 5.7 |
| | Edu.ro EDU Network | 22 | 46.8 | 42 | 79.2 |
| | Google Classroom | 2 | 4.3 | 6 | 11.3 |
| Course manual type (Multiple variable) | Pdf | 33 | 20.2 | 33 | 14.7 |
| | Book | 28 | 17.2 | 35 | 15.6 |
| | Website | 26 | 16.0 | 23 | 10.3 |
| | You Tube | 19 | 11.7 | 34 | 15.2 |
| | Printed handbook | 20 | 12.3 | 38 | 17.0 |
| Apps for teaching (Multiple variable) | Microsoft Office | 41 | 40.6 | 45 | 46.9 |
| | Gmail | 29 | 28.7 | 23 | 24.0 |
| | Google Forms | 10 | 9.9 | 4 | 4.2 |
| | Google Docs | 7 | 6.9 | 11 | 11.5 |
| | Jam board | 1 | 1.0 | 8 | 8.3 |
| Devices (Multiple variable) | Laptop | 44 | 55.0 | 50 | 45.0 |
| | Phone | 27 | 33.8 | 42 | 37.8 |
| | Projector | 2 | 2.5 | 12 | 10.8 |
| Apps for communication (Multiple variable) | WhatsApp | 32 | 31.7 | 42 | 35.9 |
| | Email | 29 | 28.7 | 35 | 29.9 |
| | Google Classroom | 24 | 23.8 | 26 | 22.2 |
| Access of the students to information (Multiple variable) | During online classes | 16 | 19.0 | 12 | 9.4 |
| | Email or WhatsApp | 25 | 29.8 | 18 | 14.1 |
| | Google Classroom | 27 | 32.1 | 33 | 25.8 |
| | You Tube | 6 | 7.1 | 21 | 16.4 |
| | During classes face-to-face | 7 | 8.3 | 27 | 21.1 |
| Main teaching methods in online (Multiple variable) | Explanation | 44 | 31.9 | 53 | 44.2 |
| | Online games | 15 | 10.9 | 5 | 4.2 |
| | You Tube movies | 21 | 15.2 | 34 | 28.3 |
| | Collaborative online project | 15 | 10.9 | 5 | 4.2 |
| | Websites | 9 | 6.5 | 11 | 9.2 |
| Main teaching methods in physical (Multiple variable) | Explanation | 43 | 33.9 | 51 | 42.1 |
| | Team work | 22 | 17.3 | 18 | 14.9 |
| | Project | 17 | 13.4 | 12 | 9.9 |
| | You Tube movies | 20 | 15.7 | 18 | 14.9 |
| Evaluation type (Multiple variable) | Online - oral | 45 | 24.2 | 32 | 12.8 |
| | Online - written, by showing answers to the camera or pictures | 38 | 20.4 | 44 | 17.6 |
| | Google Forms | 15 | 8.1 | 15 | 6.0 |
| | In physical - oral format | 31 | 16.7 | 34 | 13.6 |
| | In physical - written format | 30 | 16.1 | 35 | 14.0 |
| | In physical – project | 10 | 5.4 | 21 | 8.4 |
| | In physical - portfolio | 16 | 8.6 | 33 | 13.2 |

Source: Own determinations.

In rural areas, more teachers used videos from You Tube (31.4%) and the minimum format of the accompanying books was Word. 30-35% of teachers used Microsoft Office programs and 11% of rural teachers and 23% of urban teachers used Gmail to plan and

communicate lessons. Teachers relied primarily on their personal laptops and phones to transmit information. The most commonly used apps were WhatsApp and email (over 70%) and Google Classroom (25-27%). However, according to them, almost 40% of students had access to the information during online classes.

Regarding teaching methods, about 30% of teachers used oral explanations in class. They used online games and You Tube videos (31% in urban and 35% in rural areas), and about 9% promoted collaborative online projects (mainly in urban schools) and links to various websites (mainly in rural schools). Knowledge assessment was done online by listening orally or in writing, showing answers to the camera, or sending pictures via WhatsApp. Only 28.7% of rural teachers and 19.6% of urban teachers answered the questionnaire using Google Form.

In 2021, schools opened in a mixed mode with class rotation (students online and students physical), with some subjects online and others physical, or with classes taught entirely online, depending on the level of infestation. The mixed forms differed from the point at which stakeholders considered the number of cases in the cities/villages.

In the second section, respondents were asked to rate the amount of time they teach in hybrid ways (Table 3). Our results show an increase in users of Teams and the EDU network. Support for learning also became more diverse, from pdfs and You Tube movies to printed books and manuals. In fact, 30-32% of teachers began relying on printed versions of instructional materials, but 25-28% still used supplemental You Tube movies and websites. We also observed a decline in the use of online tools such as Google Docs or Google Forms, but teachers continued to use laptops, phones, WhatsApp, email, and Google Classroom for communication.

In rural schools, 26% of students had access to classroom materials via Google Classroom, 16% via You Tube, and 21% during class. Only a maximum of 20% still have access to textbooks via email, WhatsApp, and online.

While in online classes teaching methods remained the same, in physical classes teachers used explanations (about 34-42%), teamwork (15-17%), projects (10-13%) and You Tube movies (15-16%). Regarding assessment, in urban schools, 44% of teachers used online assessment, 8% used Google forms, and 45% used in-class assessment; in rural schools, only 28% of teachers used online assessment, 6% used online questionnaires, and almost 50% used in-class assessment. A major reason for this was that Covid cases were much more common in urban areas.

At the end of the 2021-2022 academic year, most students returned to schools and physical attendance became mandatory (the situation was the same in the academic year 2002-2023). The main digital tools were laptops and PowerPoint presentations, but 23-35% of teachers still used You-Tube movies (Table 4).

The manuals were offered to the pupils especially in printed format, only 20-25%were transmitted in pdf format.

However, we are seeing a trend toward digital apps, especially in rural areas. More and more teachers are using Google Docs instead of offline Word (about 20%), and there are more people using interactive whiteboards. We can see that due to the pandemic period, investments have been made in IT equipment and digital tools such as laptops and interactive whiteboards.

Classroom materials were delivered via digital means (WhatsApp, email, Google classroom) over 90% of the time in urban schools, but only 75% of the time in rural areas.

The rest of the teachers gave printed materials to students in class. According to respondents, students in rural areas were able to access instructional materials via Google classroom (29.5%), during class (26.3%), and You Tube (17.9%); students in urban areas were able to access instructional materials mainly via Google classroom (44%), during class (18.6%), but also via email or WhatsApp (27.1%).

Rural teachers diversified their methods by introducing YouTube materials and case studies to a large extent. Assessment was exclusively in class, and in addition to traditional assessment (oral and written), a

preference for projects was noted in urban schools and portfolios in rural schools.

Table 4. The teaching behavior of teachers during the online education period (2022-2023), by residential environments

| Variable | Labels | Urban | | Rural | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Frequency | Percent |
| Digital tools (Multiple variable) | Laptop | 12 | 40.0 | 34 | 54.8 |
| | PPT | 6 | 20.0 | 5 | 8.1 |
| | You Tube | 7 | 23.3 | 22 | 35.5 |
| Course manual type (Multiple variable) | Pdf | 28 | 24.8 | 29 | 19.3 |
| | Books | 28 | 24.8 | 41 | 27.3 |
| | Printed handbook | 23 | 20.4 | 42 | 28.0 |
| | Collection/auxiliary materials | 11 | 9.7 | 23 | 15.3 |
| Apps for teaching (Multiple variable) | Microsoft Office | 34 | 47.2 | 35 | 38.0 |
| | Gmail | 19 | 26.4 | 13 | 14.1 |
| | Google Forms | 9 | 12.5 | 5 | 5.4 |
| | Google Docs | 3 | 4.2 | 19 | 20.7 |
| Devices (Multiple variable) | Laptop | 45 | 60.0 | 53 | 52.5 |
| | Interactive board | 17 | 22.6 | 24 | 23.8 |
| Apps for communication or the way the teaching materials are transmitted (Multiple variable) | WhatsApp | 22 | 30.6 | 27 | 29.3 |
| | Email | 21 | 29.2 | 26 | 28.3 |
| | Google Classroom | 21 | 29.2 | 16 | 17.4 |
| | Printed handbook | 6 | 8.3 | 17 | 18.5 |
| Access of the students to information (Multiple variable) | Email or WhatsApp | 16 | 27.1 | 4 | 4.2 |
| | Google Classroom | 26 | 44.1 | 28 | 29.5 |
| | During classes face-to-face | 11 | 18.6 | 25 | 26.3 |
| | YouTube | 3 | 5.1 | 17 | 17.9 |
| Main teaching methods in physical (Multiple variable) | Explanation | 45 | 30.2 | 53 | 30.1 |
| | Team work | 20 | 13.4 | 15 | 8.5 |
| | Project | 22 | 14.8 | 15 | 8.5 |
| | You Tube movies | 20 | 13.4 | 35 | 19.9 |
| | Case studies | 17 | 11.4 | 27 | 15.3 |
| Evaluation type (Multiple variable) | In physical - oral format | 42 | 31.8 | 52 | 33.1 |
| | In physical - written format | 43 | 32.6 | 47 | 29.9 |
| | In physical – project | 14 | 10.6 | 32 | 20.4 |
| | In physical - portfolio | 24 | 18.2 | 23 | 14.6 |

Source: Own determinations.

Table 5. Integration of technology in the teaching methods

| Variable | Labels | Urban | | Rural | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Frequency | Percent |
| Traditional teaching methods (Multiple variable) | Worksheet | 32 | 22.9 | 41 | 18.6 |
| | Handbook | 29 | 20.7 | 43 | 19.5 |
| | Explanation | 21 | 15.0 | 38 | 17.2 |
| | Exercises | 18 | 12.9 | 39 | 17.6 |
| | Collection | 19 | 13.6 | 33 | 14.9 |
| Modern teaching methods (Multiple variable) | IT equipment (laptop, video projector, tablet) | 18 | 30.5 | 5 | 8.1 |
| | Learning through discovery | 17 | 28.8 | 37 | 59.7 |
| | YouTube | 5 | 8.5 | 7 | 11.3 |
| Digital tools in the future (Multiple variable) | Laptop | 41 | 31.5 | 52 | 25.6 |
| | Email | 19 | 14.6 | 33 | 16.3 |
| | You Tube | 18 | 13.8 | 38 | 18.7 |
| | Websites | 18 | 13.8 | 36 | 17.7 |
| | PPT | 18 | 13.8 | 36 | 17.7 |

Source: Own determinations.

After all the experience from 2020-2022, we find that there has been little change in the behaviour of teachers. In the last section of the survey, they were asked to indicate which teaching methods and digital tools they would like to use in the future. They see the use of IT and You Tube as modern teaching methods (especially in urban areas), alongside discovery learning, which is the main method in rural areas (almost 60%) (Table 5).

Moreover, only 27% of urban teachers and 36% of rural teachers plan to use YouTube movies and websites in their activities in the future.

## CONCLUSIONS

Digitization is a challenge for the Romanian education system [1], while many stakeholders talk about the digitization of education. Almost all teachers from urban and rural schools are also confused about these concepts. We need to understand that digitization means transferring information into digital technologies, while digitalization means transforming information (which is analogue) into digital information.

In 2020-2022, we have not developed any of these processes in education. We have simply subjected education to a forced digital transformation, i.e., we have used current digital technologies to impart knowledge to students. In this situation the teachers.

In this context, teachers were content to acquire or apply basic skills in the use of computer programs. For them, the use of a laptop or ppt still represents the modern teaching method. The only digital developments observed are: the supplementation of the information from the courses with You Tube videos or with links to different websites through which students can access the information; the use of Google Classroom as a storage medium for manuals or exercise books in general pdf format (an activity that has been reduced after the return to face-to-face teaching); the use of email or the WhatsApp application for communication (but this too has been reduced as the communication between students and teachers in class is being redeveloped, leaving these applications as a backup).

There are few teachers who have actually tried to create digital content using various apps like Kahoot or Powtoon, and the number using them in the present is even smaller.

However, we must understand that teachers do not have the skills to develop such content. Our research found that they were willing to use various existing applications (especially in rural areas) to support the educational process. But this is an institutional problem, not a knowledge problem. They need support from specialized companies, access to digital tools that can be used to create content (and that are usually paid for), and also training in how to use them. Simply having interactive tablets or computers does not mean that we are introducing digitalization or digitalization in education.

We need digital tools and digital content to support modern education, which is innovative learning accompanied by technology or the use of apps that can support blended learning. Otherwise, all we can have been a digital transformation but with the same out-of-date content.

In our opinion, it's not the curricula that's the problem, but the way we try to convey information to Generation Z children. Nearly half of our respondents said that their students prefer face-to-face instruction and traditional teaching methods. Then we ask again a simple question that seems to have no answer in our society: if our current way of teaching is better, why is student achievement so poor? If we believe that students prefer to read a book, why are they so attracted to phones? We teachers need to adapt, and we need stakeholder support to do so.

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# RENEWABLE ENERGY, AN INFLUENTIAL FACTOR IN THE DEVELOPMENT OF THE DANUBE TRANSPORT CORRIDORS ROMANIA - BULGARIA AND A SUPPORT MECHANISM IN INTERMODAL CONNECTIONS

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***Abstract***

*The paper aims to present the need and the importance of using efficiently the energy and finding new ways to improve the transport based on renewable energy. The paper is based on a large number of official information sources which are structured and presented in the author's opinion. The main results emphasize that the Danube region is a large river basin and ecological corridor requiring a regional approach to nature conservation, spatial planning and water management. The environmental impact of transport links, tourist constructions or new energy production facilities must also be considered. Transport policy has been given a new direction: achieving a 'sustainable through flexibility' system, which means organizing transport in such a way as to optimize energy consumption. The development of the national transmission system shall be carried out in accordance with the requirements of conservation and environmental protection and the rational use of energy. The protection of human life and the environment is a priority in all transport-related relations.*

***Key words*****:** *renewable energy, Danube, transport, cross-border, cable project*

## INTRODUCTION

The European Green Deal regarding the Danube Region has the purpose to strengthen and join the efforts for assuring the sustainability of the economic development preserving environment and mitigating the impact of climate change by sustaining the connectivity and involving research and innovation [8].

On 12 of February 2015 was launched Interreg 2014 – 2020, a project of cooperation between Romania and Bulgaria, a project financed by the European Union from the European Regional Development Fund having the main purpose “developing the border area between the two countries through joint projects”. (University of Craiova, ”The Ecological Initiative and Sustainable Development Group" Foundation, 2016-2018) [11].

Interreg is built around three areas of cooperation: cross-border (Interreg A), transnational (Interreg B) and interregional (Interreg C). European cross-border cooperation, known as Interreg A, supports cooperation between regions from at least two different Member States, regions which are located on or near each other's borders. It aims to address common challenges identified in the border region and to develop untapped growth potential in border areas, while strengthening the cooperation process for the harmonious development of the European Union.

The programme document jointly developed by Romania and Bulgaria was approved by the European Commission on 10 February 2015.

The Programme brings an extraordinary perspective for regional development based on concrete results with the capacity for the two countries, Romania and Bulgaria, to offer the most modern land, river, sea and energy infrastructure in the next 25 years (The Interreg V-A Romania- Bulgaria Programme, 2016) [12].

In this context, the purpose of the paper is to present the objectives and achievements of the Project developed within The Interreg V-A

Romania- Bulgaria Programme, pointing out the importance of using efficiently the energy and finding new ways to improve the transport based on renewable energy.

## MATERIALS AND METHODS

For attaining the purpose of the paper, there were studied numerous official information sources from European Union Council and Parliament, Ministry of Foreign Affairs of Romania, research articles published on the topic and the documents of the Project The Interreg V-A Romania- Bulgaria Programme.
The project addressed problems of accessibility, efficiency, ecology and safety of secondary/tertiary nodes connection to TEN-T infrastructure in the cross-border region.
The main objective of the proposed action is to significantly improve the planning, development and coordination of cross-border transport systems for better connections with TEN-T network in the CBC area. This is done through investment in the study, planning and adoption of strategic documents on optimizing of the transport system through enhanced intermodal transport connections in the cross-border region.
The Danube region is a large river basin and ecological corridor, requiring a regional approach to nature conservation, spatial planning, and water management. Pollution does not respect national borders. Sustainable water management is needed, with a joint effort to reduce pollution from organic substances, nutrients, and hazardous substances.
The environmental impact of transport links, tourist developments and new energy production facilities must also be considered.

## RESULTS AND DISCUSSIONS

The multinational within the implementation of the EU strategy for the development of the Danube region is destined to create permanent direct and strong links between the involved countries, regions, and communities to join their efforts for the sustainable economic, social and environment development [1, 2, 3].
A major accent is put on the creation of a corridor where the renewable energy to connect the Black Sea and the countries along the Danube River [10, 13].
The energy hub on the Danube - Black Sea corridor has become the transmission belt for renewable energy as well as transportable energy from countries agreed in the Danube - Black Sea energy cluster.
Thus, the President of the European Commission, Ursula von de Leyen, participated together with the President of Romania, Klaus Iohannis, in the signing of the Agreement between the Governments of Romania, Hungary, Georgia and Azerbaijan on the strategic partnership in the field of green energy transport.
The Agreement will provide the financial and technical framework for the implementation of the project of the submarine cable for the transport of electricity from renewable sources between Romania and Azerbaijan, via Georgia and the Black Sea, and, subsequently, for the transport of this energy to Hungary and the rest of Europe, through the European transport system.

Map 1. The Black Sea Submarine Cable Project
Source: [10, 13].

The Black Sea Submarine Cable Project [10] is part of the agreements in the energy field between the European Union, represented by the European Commission and Azerbaijan, also being a flagship project for Georgia, as part of the EU Global Gateway strategy (Map 1).
The Strategic Partnership in the field of green energy development and transmission is an ambitious project aimed at the development of the submarine electricity transmission cable in

the Black Sea (to be completed in September 2023). The cable will take six years to complete and will be 1,195 kilometres long.

The Green Partnership on energy confirms the concern of all countries bordering the Danube and Black Sea to cooperate in ensuring the supply of renewable electricity [6].

Countries that connect to such a project, such as Georgia, clearly show that the geopolitical problems and the war in Ukraine have brought to the attention of the European Union the need to diversify and adapt to rapid methods in the energy field.

Georgia has become a member of the Danube-Black Sea energy cluster, a bridge between the West and Central Asia.

All countries involved in the Danube-Black Sea energy hub see a tremendous opportunity to invest in expanding and upgrading their energy and communications infrastructure in line with European standards.

The submarine cable project presents an extraordinary perspective for the energy independence of the countries in the Danube and Black Sea basins, becoming a transport bridge in the critical energy infrastructure of the EU and beyond.

The agreement in Romania - Hungary, Georgia, Azerbaijan launched the strategic partnership in the field of green energy development and transport, responds as vision and implementation to an urgent need to increase the share of green energy and energy security. Romania is committed to investing in energy production and energy infrastructure.

The agreement to increase the share of green energy and energy security in the Black Sea basin and the Danube corridor strengthens the perspective of EU projects for the future of green energy by 2030.

Our potential and resources are essential, stressed senior Romanian representatives for a sustainable Danube-Black Sea energy future.

Romania is committed to investing in energy production and energy infrastructure and in cooperation with partners to help us promote energy security for ourselves and for the whole region. Romania will play an important role as a transit country, as an energy hub, offering alternatives to our neighbours and partners in the European Union, but also to two other countries bordering the Danube and the Black Sea, Moldova and Ukraine.

According to the Ministry of Foreign Affairs of Romania, the EU strategy for the Danube Region (SUERD) is destined to develop the interconnection in the Danube region, the environment protection, the growth of prosperity in the area, and the consolidation of the region. The benefits for Romania are the improvement of life quality and the attractiveness of the localities, economic business partnerships in the public and private sectors, investments in transport infrastructure, environment and energy, expertise and competence transfer by transnational cooperation, an increased absorbing capacity of structural funds [4, 7].

The bilateral cooperation between Romania and Bulgaria and the project developed by ”The Ecological Initiative and Sustainable Development Group" Foundation and the Association of Danube Municipalities in Bulgaria, has undertaken extensive research based on the total budget of the Interreg VA Romania - Bulgaria Programme of 258.504.126,00 euro, of which 215.745.513,00 euro from the European Regional Development Fund.

The area involved in the Border Cooperation Programme between Romania and Bulgaria is shown on the Map 2.


Map 2. Area of the Border Cooperation Programme between Romania and Bulgaria
Source: [9].

The Programme activated five priority axes and technical assistance as follows:

- A well-connected region
- A green region (renewable energy infrastructure)
- A secure region

- A skilled and inclusive region
- An efficient region
- Technical assistance.

Investigating opportunities to reduce the use of the TEN-T network in the Romania-Bulgaria cross-border region by optimising freight and passenger transport and developing a common mechanism to support intermodal connection is an objective we aim to achieve in the period 2021-2025 by continuing the project or succeeding in significantly improving the process of planning, development and coordination of transport systems for better connection to the TEN-T network in the cross-border region, using the capacity of intermodal nodes.

The aim of TEN-T is to build a transport network that facilitates the flow of goods as well as the transport of renewable energy between the countries of the European Union. The aim is for the green energy hub to progressively provide the majority of Europe's citizens and businesses with green energy at the right and sustainable price for future generations by 2050.

The initiatives of , "The Ecological Initiative and Sustainable Development Group" Foundation and the Association of Danube Municipalities in Bulgaria achieved a better planned transport infrastructure; address the missing parts in infrastructure in the cross – border cooperation region (road, rails, inland), decarbonization of infrastructure and services.

The initiatives lead to enhancing the use of Danube (core TEN-T infrastructure) and intermodal terminals (inland ports) in secondary/ tertiary nodes on Danube.

The Green Energy Hub signed as an agreement in Bucharest on December 17, 2022, in the presence of European Commission President Ursula von der Leyen, brings the green energy component into the trans-European transmission grid.

The strategic partnership in the field of green energy development and transport will follow the trajectory of the trans-European transport network that has developed and is to develop through nine other transport corridors:

- Baltic-Adriatic Corridor;
- North Sea-Baltic Sea Corridor;
- the Mediterranean Corridor;
- the East-East-Med Corridor;
- Scandinavian-Mediterranean Corridor;
- Rhine-Alpine Corridor;
- Atlantic Corridor;
- North Sea-Mediterranean Corridor;
- Rhine-Danube corridor (Map 3).

Map 3. Main transport corridors
Source: [5]

Two of the nine transport corridors cross the Romania-Bulgaria cross-border area, namely:

-The East/East-Med Corridor, linking the North Sea, the Baltic Sea, the Black Sea and the Mediterranean Sea, thus optimising the use of the relevant ports and motorways of the sea;

-The Rhine-Danube Corridor, with the Main and Danube waterway as its backbone, linking the central regions around Strasbourg and Frankfurt with Vienna, Bratislava, Budapest and finally the Black Sea, with an important branch through southern Germany.

The core network will connect:

-94 major European ports with rail and road connections;

-38 key airports with rail connections to major cities;

-15,000 km of upgraded high-speed railway lines;

-35 cross-border projects to reduce bottlenecks

## CONCLUSIONS

The Romanian Danube cross-border area along the Danube is one where the investments are left to be expected, the economic situation not being too good.
The project Interreg V-a is a very well-articulated guide that will continue the documentation that will also help to start the necessary work to build an economic interconnection platform that will ensure the coherence of the 12 countries located between the Adriatic Sea, the Baltic Sea and the Black Sea with what the Danube Corridor means.
The partnership will increase the focus on delivering a reformed carbon market platform from 2027 onwards. Reducing carbon emissions will greatly increase the emphasis on reforms to change polluting industries in the European Union.
A new carbon market will be launched from 2027 covering suppliers of CO2 emitting fuels used in the car manufacturing industry as well as other industries.
From the damage caused by climate changes to environmental disasters, the whole planet is mobilizing. We need a green planet that provides a secure life for future generations. Sustainability is not a concept, but an obligation of all citizens on the planet.
Will the Green Deal, the UN Climate Change Conference (COP26) (the most important summit after the 2015 Paris climate change summit), the 2020-2030 Agenda and many other globally recognised actions succeed in reducing pollution and carbon emissions by 2030?
It's up to all of us to lend a hand in the big change!

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Project INTERREG V-A Romania-Bulgaria Programme 2014-2020, “Investigation of opportunities for reducing the TEN-T network use within the cross-border region Romania-Bulgaria through optimization of the freight and passenger transport and the development of a joint mechanism for support of the intermodal connections, Intermodal cross-border cooperation had the specific object to improve the planning, development and coordination of cross-border transport systems for better connections to TEN-T transport networks.

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# EXPLORING THE RISE OF ORGANIC AGRICULTURE IN EUROPE: COMPARATIVE ANALYSIS AND THE ROMANIAN PERSPECTIVE

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***Abstract***

*The primary aim of this article is to analyze the progression of organic farming at the European level, with emphasis on trends and changes in the cultivated area under this system. The article seeks to underscore the significance and benefits associated with organic farming, particularly in response to the detrimental effects of conventional agriculture on the environment and human health, and to provide relevant information for the promotion and adoption of sustainable practices in agriculture. In light of extensive research, agricultural experts have acknowledged the adverse environmental and health consequences of conventional agriculture over the course of several decades. Consequently, they have embraced organic farming, which draws inspiration from traditional farming methods spanning thousands of years. By employing statistical analysis and utilizing data from reputable sources, the study highlights the increasing prevalence of organic farming across Europe, specifically exploring the perspective of Romania.*

***Key words*****:** *ecological agriculture, conventional agriculture, sustainable practices, conversion, environmental impact*

## INTRODUCTION

The essence of life on Earth, whether animal or human, is fundamentally supported by nature, which provides us with food, shelter and for us humans, clothing. However, the increased pressures caused by the rapid growth of the human population and the ever-increasing demands, especially for food, began to strain nature's resources. In this context, we have become increasingly dependent on the production of our own food and materials for construction and clothing, by intensifying the use of the main elements of agriculture: soil, climate, plants and animals [1].

With the advent of the Green Revolution, to meet the growing demand for agricultural products, the conventional farming system was adopted [17]. But over time, as the pursuit of profit advanced, agriculture became more and more separated from nature [15]. Parallel to this process, human innovations have also advanced - mechanization, chemicalization, irrigation, and more recently, genetic engineering. The result is an increasing and more harmful impact on nature, manifested by destructive phenomena such as floods, landslides, avalanches, reduction of natural soil fertility, pollution, desertification, etc [6]. Diseases affecting the immune systems of plants, animals and humans have also increased. Conventional agriculture, an essential component of the developing economic model [3], has pursued in the last decades the main objectives of any industry: the maximization of profits and the efficiency of the labor force [4, 18]. To achieve this, he tried to increase productivity, that is, the amount of agricultural products per unit area [12], and implemented mechanized technologies [1]. This process led to the application of intensive farming techniques, with a large capital invested in external resources. The results were impressive in terms of product quality and quantity, with a significant economic impact [11].

However, this success was not without consequences. The environmental impact has been substantial, including soil and water pollution, the disappearance of non-harmful but chemically sensitive insects, the development of pesticide resistance, and the loss of biodiversity [14].

In this context, organic agriculture is gaining more and more ground [19]. This trend is fueled by an increase in consumer demand for organic agricultural products as they become more aware of the impact of food on their health [13]. There is also increasing social pressure for sustainable agricultural development, as well as a recognition of the benefits that organic farming brings both at the farm level and in the environment [7].

Organic farming is a production system that combines respect for soil, ecosystems and people with innovation and scientific research [20]. It aims to promote fair relations and a better quality of life for all those involved in the agri-food chain: farmers, processors, distributors, traders and consumers [2]. From a socio-economic perspective, organic farming, being labor-intensive, supports rural employment and community growth. Organic products typically fetch higher market prices, potentially improving farmers' livelihoods.

The debate on organic farming's role in food security continues, yet despite typically lower yields, its resilience to environmental stressors and contribution to dietary diversity are noteworthy [7]. This approach has encouraged many farmers to transform part of their land into organic farming areas, a fact reflected by the accelerated growth of organically cultivated areas in recent years in Romania [8].

In order to establish a sustainable agricultural future, it becomes imperative to integrate the key advantage of conventional farming, which is high productivity, with the benefits of ecological agriculture, particularly the reduced reliance on chemical substances. By merging these two approaches, we can achieve a harmonious balance that combines efficient agricultural production with environmentally-friendly practices. This integration holds the potential to address the growing concerns associated with conventional farming methods, such as the excessive use of pesticides and fertilizers, and their negative impacts on ecosystems and human health. By incorporating the best aspects of both systems, we can pave the way for a more sustainable and ecologically-responsible approach to agriculture [10].

## MATERIALS AND METHODS

As research methods we used documentation, analysis and data processing. These methods are based on processes of synthesis, analogy and comparative analysis. Once the information was defined, known and interpreted, the next step was to document the area of interest in detail.

The data used in this study were provided by Eurostat. In the analysis activity, the study and documentation for the domain or for the analyzed system is a starting point. They allow analysis to obtain the first knowledge and information.

## RESULTS AND DISCUSSIONS

In general, the area cultivated in the organic system has increased significantly in recent years, a trend observed worldwide [20]. In Europe, for example, the area of land devoted to organic farming has increased steadily over the last decade, although the rate of increase has varied by country and crop [5].

In contrast, the area under conventional cultivation has remained relatively stable or decreased in some regions, in part due to the shift to more sustainable farming methods [6].

Considerable variations exist depending on the type of crop cultivated. For instance, when analyzing cereals, a notable trend emerged, indicating a more rapid expansion of cultivated areas within the organic farming system as opposed to the conventional system [16]. In contrast, for some crops such as soy, the trend was the opposite, with a faster expansion of the areas cultivated in the conventional system [1].

In the last decade, between 2012 and 2021, there has been a considerable increase in organically cultivated areas in most European countries. Despite the differences in organic

and conventional farming, we see a constant upward trend in organic farming. This may reflect an increase in awareness and concern for the environment, as well as a growing demand for organic agricultural products.

Between 2012 and 2021, organic farming has seen significant growth in several European countries, reflecting the growing interest in sustainable agricultural practices and respect for the environment [9]. Romania stands out in this context, registering a positive evolution in organic agriculture.

In 2012, the area cultivated organically in Romania was 288,261 hectares, and in 2021 this increased to 578,718 hectares, reflecting a significant increase of approximately 101% in a span of just nine years. This shows a growing interest of Romanian farmers for ecological agriculture and the adoption of sustainable practices in the field [19]. This growth is encouraging and indicates a strong transition towards a more sustainable agricultural system in the country (Table 1).

Table 1. Total area converted and under conversion to organic farming at EU level – 2021 vs 2012

| | 2012 | 2021 |
|---|---|---|
| France | 1,030,881 | 2,775,671 |
| Spain | 1,756,548 | 2,635,442 |
| Italy | 1,167,362 | 2,186,159 |
| Germania | 959,832 | 1,601,316 |
| Portugal | 200,833 | 768,800 |
| Austria | 533,230 | 700,392 |
| Sweden | 477,684 | 606,669 |
| Romania | 288,261 | 578,718 |
| Greece | 462,618 | 550,668 |
| Poland | 655,499 | 549,443 |
| Czechia | 468,670 | 548,792 |
| Finland | 197,751 | 365,379 |
| Denmark | 194,706 | 303,093 |
| Latvia | 195,658 | 302,177 |
| Hungary | 130,607 | 293,597 |
| Lithuania | 156,539 | 261,782 |
| Estonia | 142,065 | 226,605 |
| Slovakia | 164,360 | 162,565 |
| Croatia | 31,904 | 121,924 |
| Belgium | 59,718 | 102,413 |
| Ireland | 52,793 | 86,868 |
| Bulgaria | 39,138 | 86,310 |
| Netherlands | 48,038 | 76,375 |
| Slovenia | 35,101 | 51,826 |
| Cyprus | 3,923 | 7,738 |
| Luxembourg | 4,130 | 6,893 |
| Malta | 37 | 66 |

Source: Eurostat, 2023 [5].

In terms of other European countries, France is at the top of the ranking, with an impressive increase in organically cultivated areas. In 2012, the extent of land devoted to organic farming in France amounted to 1,030,881 hectares, which subsequently experienced a substantial rise to 2,775,671 hectares by 2021. This noteworthy expansion demonstrates the resolute dedication of French farmers towards organic farming practices and the adoption of sustainable approaches. Similarly, Spain ranks among the leading countries witnessing significant growth in organically cultivated areas. In 2012, Spain recorded 1,756,548 hectares dedicated to organic farming, and by 2021, this figure escalated to 2,635,442 hectares.

Italy has also seen a significant increase in organically cultivated areas.

In 2012, Italy had 1,167,362 hectares dedicated to organic farming, and in 2021 this increased to 2,186,159 hectares.

Germany and Portugal are also among the countries that have seen a significant increase in organically cultivated areas. Germany went from 959,832 hectares in 2012 to 1,601,316 hectares in 2021, while Portugal increased from 200,833 hectares in 2012 to 768,800 hectares in 2021.

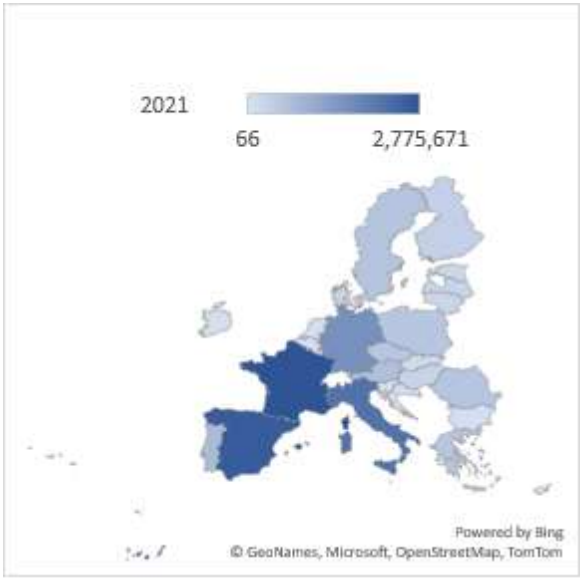


Fig. 1. Ecological crop area converted and under conversion, 2021

Source: Own representation based on Eurostat data, 2023 [5].

These figures highlight the fact that organic farming is gaining more and more ground in Europe, and the countries mentioned are at the forefront of this trend. The shift to ecological agricultural practices is evidence of increased awareness and concern for the environment and human health (Figure 1). From another perspective, we can analyze the data on the share of land completely converted and those in the process of conversion to organic agriculture in the period 2012-2021 through the perspective of the percentage evolution and the ranking of the countries.

The hierarchy among key players in organic farming has remained consistent over time, with France, Spain, and Italy consistently occupying the top three positions in terms of the proportion of converted land to organic farming in 2021. France retains its leading position with a share of 17.62% of converted land in 2021, followed by Spain with a share of 16.73% and Italy with a share of 13.88%. These countries serve as exemplary models of success in promoting organic farming and implementing sustainable practices within the agricultural sector. Germany and Portugal rank closely behind, accounting for 10.16% and 4.88% of the converted land respectively in 2021. These countries have also experienced notable increases in recent years, indicating a growing interest in organic farming practices.

Romania is 8th in the ranking, with a share of 3.67% of land converted in 2021. Although the share is lower compared to France, Spain and Italy, Romania has seen significant growth in recent years, with an increase of 200.76% in the analyzed period. This indicates a growing interest of Romanian farmers for ecological agriculture and the adoption of sustainable practices.

Other countries such as Greece, Poland, the Czech Republic, Finland and Denmark are in the 3% to 2% weight range, reflecting their commitment to organic farming.

It is important to note that the share of land converted to organic farming should not only be analyzed in absolute numbers, but also in the context of the size and agricultural structure of each country.

The share may be influenced by factors such as the size of the total agricultural areas, the existing agricultural structure and the agricultural policy adopted by each country.

Table 2. Total area converted and under conversion to organic farming at EU level

| | 2012 | 2015 | 2020 | 2021 | 2021/2012 | 2021% |
|---|---|---|---|---|---|---|
| **UE27** | 9,457,886 | 10,609,926 | 14,724,279 | 15,754,979 | 166.58 | 100 |
| **France** | 1,030,881 | 1,322,911 | 2,517,478 | 2,775,671 | 269.25 | 17.62 |
| **Spain** | 1,756,548 | 1,968,570 | 2,437,891 | 2,635,442 | 150.04 | 16.73 |
| **Italy** | 1,167,362 | 1,492,571 | 2,094,592 | 2,186,159 | 187.27 | 13.88 |
| **Germania** | 959,832 | 1,060,291 | 1,590,962 | 1,601,316 | 166.83 | 10.16 |
| **Portugal** | 200,833 | 241,375 | 319,540 | 768,800 | 382.81 | 4.88 |
| **Austria** | 533,230 | 552,141 | 679,992 | 700,392 | 131.35 | 4.45 |
| **Sweden** | 477,684 | 518,983 | 610,543 | 606,669 | 127.00 | 3.85 |
| **Romania** | 288,261 | 245,924 | 468,887 | 578,718 | 200.76 | 3.67 |
| **Greece** | 462,618 | 407,069 | 534,629 | 550,668 | 119.03 | 3.50 |
| **Poland** | 655,499 | 580,731 | 509,286 | 549,443 | 83.82 | 3.49 |
| **Czechia** | 468,670 | 478,033 | 540,375 | 548,792 | 117.10 | 3.48 |
| **Finland** | 197,751 | 225,235 | 316,248 | 365,379 | 184.77 | 2.32 |
| **Denmark** | 194,706 | 166,788 | 299,998 | 303,093 | 155.67 | 1.92 |
| **Latvia** | 195,658 | 231,608 | 291,150 | 302,177 | 154.44 | 1.92 |
| **Hungary** | 130,607 | 129,735 | 301,430 | 293,597 | 224.79 | 1.86 |
| **Lithuania** | 156,539 | 213,579 | 235,471 | 261,782 | 167.23 | 1.66 |
| **Estonia** | 142,065 | 155,806 | 220,796 | 226,605 | 159.51 | 1.44 |
| **Slovakia** | 164,360 | 181,882 | 222,896 | 162,565 | 98.91 | 1.03 |
| **Croatia** | 31,904 | 75,883 | 108,610 | 121,924 | 382.16 | 0.77 |
| **Belgium** | 59,718 | 68,818 | 99,072 | 102,413 | 171.49 | 0.65 |
| **Ireland** | 52,793 | 73,037 | 74,666 | 86,868 | 164.54 | 0.55 |
| **Bulgaria** | 39,138 | 118,552 | 116,253 | 86,310 | 220.53 | 0.55 |
| **Netherlands** | 48,038 | 49,273 | 71,607 | 76,375 | 158.99 | 0.48 |
| **Slovenia** | 35,101 | 42,188 | 49,803 | 51,826 | 147.65 | 0.33 |
| **Cyprus** | 3,923 | 4,699 | 5,918 | 7,738 | 197.25 | 0.05 |
| **Luxembourg** | 4,130 | 4,216 | 6,118 | 6,893 | 166.90 | 0.04 |
| **Malta** | 37 | 30 | 67 | 66 | 178.38 | 0.00 |

Source: Eurostat, 2023 [5].

Thus, analyzing the data on the share of completely converted lands and those in the process of conversion to organic agriculture from another perspective, we can observe the ranking of the main players in the field and their percentage evolution in the period 2012-2021.

France, Spain and Italy remain at the top of the ranking, while Romania registers a significant increase and is in 8th place (Table 2).

Returning to Romania's situation, between the years 2012 and 2021, a significant increase in the total area dedicated to organic agriculture is observed, from 288,261 hectares in 2012 to 578,718 hectares in 2021, representing an increase of approximately 101% in a span of only nine years.

he data regarding land fully transitioned to organic farming demonstrates consistent and substantial expansion. In 2012, the total area amounted to 103,093 hectares, and by 2021, it had surged to 344,541 hectares, marking a remarkable growth rate of over 234%. This sustained increase underscores a resolute and sustainable dedication to organic farming practices. However, when considering land in the process of conversion, the figures display varying fluctuations over the years.

In 2012, the area was 185,168 hectares, it reached a minimum level in 2016, with 76,696 hectares, and in 2021 it reached 234,177 hectares.

Overall, the data reflect an upward trend of organic farming in Romania, with a considerable increase in the areas cultivated in this way, both in terms of fully converted lands and those in the process of conversion (Figure 2).

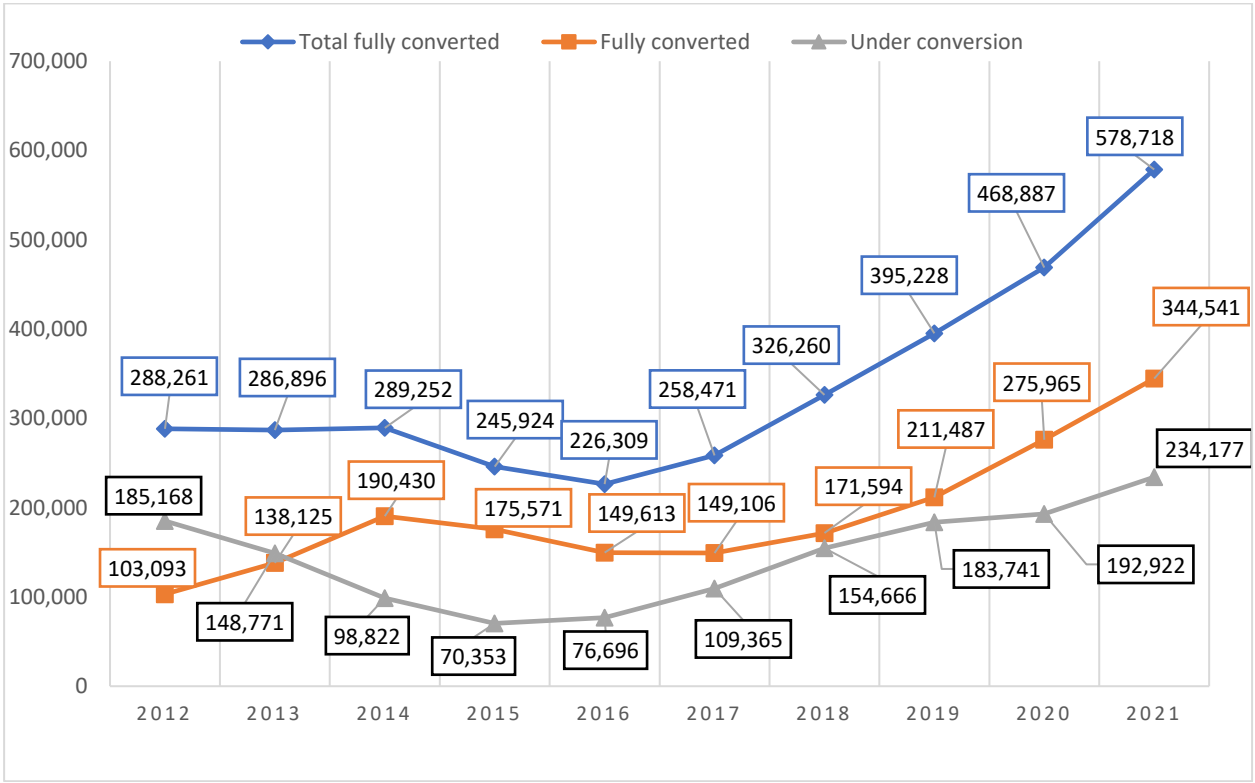


Fig. 2. The evolution of the area cultivated in the ecological system at the level of Romania
Source: Own representation based on Eurostat data, 2023 [5].

While Romania had an increase of almost 101% (from 288,261 ha in 2012 to 578,718 ha in 2021), the total area of organic agriculture in the EU increased by about 56% (from 9,457,886 ha in 2012 to 14,724 .279 ha in 2019, this being the last year for which we have data).

The data suggest that Romania had a faster growth rate than the EU average in the expansion of organic farming. However, it is important to note that, in absolute terms, the

area dedicated to organic farming in Romania remains much smaller compared to the EU total.

## CONCLUSIONS

Organic farming is a critical shift in agricultural methods, offering a pathway towards a more sustainable future with profound impacts on health, environment, and socio-economy.

Its health benefits are notable as it limits the use of harmful synthetic pesticides and fertilizers, often resulting in produce with higher nutritional value and less heavy metals compared to conventionally grown food.

Environmentally, organic farming can mitigate degradation by boosting soil fertility, preserving biodiversity, safeguarding water quality, and reducing greenhouse gas emissions. It also leverages nature for pest and nutrient management, thus enhancing agricultural resilience against climate change.

In sum, organic farming, while addressing many challenges of conventional practices, provides a sustainable, health-conscious, and biodiversity-friendly approach to feeding the expanding global population.

Organic farming has emerged as an increasingly preferred and necessary alternative, owing to the adverse effects of conventional agriculture on the environment and health. This study focused on analyzing the evolution of organic farming in Romania and identified trends at the European level.

We discovered that there has been a significant expansion in the areas cultivated under organic farming in recent years. This growth is evident at both national and European levels. Romania, in particular, has witnessed a swift increase in areas dedicated to organic farming, notably in fully converted lands. Despite this progress, however, the overall land area dedicated to organic agriculture in Romania remains relatively minor when compared to other European nations.

This study further accentuates that the proportion of land converted to organic farming should be scrutinized within the context of each country's size and agricultural structure. The hierarchy of leading nations in organic farming remains stable, with France, Spain, and Italy leading the pack in terms of land area converted to organic farming.

The implications of these findings necessitate the persistent promotion of organic farming and the embrace of sustainable practices in agriculture. This doesn't imply discarding conventional agriculture entirely, which is often more productive, but rather supplementing it with organic farming's benefits, such as lesser dependence on chemical substances. This integration could offer a plausible solution to achieving equilibrium between fulfilling food requirements and protecting the environment.

In conclusion, it's clear that organic farming is gradually gaining a firmer foothold in Europe. The rising interest and adoption of sustainable agricultural practices denote a significant stride toward a more sustainable, eco-friendly agricultural system. This study underscores the importance of this transition and reiterates the need for ongoing research in this field to guarantee a healthy and sustainable agricultural future. We need to reconcile the global need for food security with environmental sustainability, and organic farming in Romania and across Europe shows promising potential to help us achieve this balance.

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# FARM SIZE AND SPECIALIZATION STRUCTURE IN THE EUROPEAN COUNTRIES IN THE YEAR 2020

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***Abstract***

*The purpose of this article is to analyze the evolution of the areas cultivated in the conventional system, comparing the data at European and at the national level. With a solid foundation in analyzing data obtained from various agricultural organizations, this study aims to elucidate current trends and provide an in-depth understanding of how conventional agriculture is changing. The analysis regards the year 2020 for which Eurostat provided data which were used for identifying similarities and differences between different EU member states exploring the potential reasons for these variations. By analyzing these trends, the article seeks to identify the impact of conventional agriculture on the environment and human health, as well as how agricultural practices are changing to become more sustainable and less harmful. The conclusion is that agricultural structure of the countries of the European Union is extremely diverse, reflecting the traditions, economy, geographical conditions, agricultural policy and many other aspects specific to each member state. It is obviously needed to continue and intensify efforts for increasing farm size, modernizing technical endowment and improving efficiency in the agricultural sector in the EU, especially in countries with a high share of small farms.*

***Key words*****:** *conventional agriculture, farming systems, ecnomic efficiency, agricultural trends*

## INTRODUCTION

Conventional agriculture, dominant for much of the last century, has been an efficient and productive way to meet the growing needs of the global population [10,15].

In essence, conventional agriculture refers to an intensive farming system that relies on the use of modern technologies, including mechanized irrigation, agricultural machinery, chemical fertilizers and pesticides [13, 24].

Although conventional agriculture has enabled increased food production worldwide, it has also been associated with several environmental and health problems [23].

These include soil erosion caused by intensive farming practices, water pollution from fertilizers and pesticides, loss of biodiversity caused by extensive monocultures, and pesticide resistance, an emerging problem that reduces the effectiveness of these chemicals and may lead to increased use [21, 22].

Despite these challenges, conventional agriculture remains an essential component of our food system [18].

At the European and national level, the areas cultivated in the conventional system still occupy a significant percentage of agricultural land [7].

However, it is clear that agriculture is in a process of transformation, with an increase in interest in sustainable and ecological agricultural practices [8, 9].

In this context, it is crucial to understand how the areas cultivated in the conventional system evolve, in order to anticipate the future directions of this vital field [11, 12, 26].

In the following sections, the study is focused on the evolution of conventionally cultivated areas at European and national level, trying to emphasize current and future trends.

## MATERIALS AND METHODS

In the process of this research, it was adopted a rigorous methodology for data collection, analysis and comparison. The first step was to collect data from the Eurostat database, the main source of statistical data at the level of the European Union.

Once collected, the data were subjected to analysis, focusing on understanding the evolution over time of the areas cultivated in the conventional system, analyzing the trends and changes that have occurred over the years. The analysis involved comparing national and European data, identifying similarities and differences between them, and exploring potential reasons for these variations.

All these steps were carried out in a systematic and transparent manner to ensure the accuracy and relevance of the results. By adopting this approach, it is expected to obtain a clear and complete picture of the evolution of conventionally cultivated areas, both at European and national level.

## RESULTS AND DISCUSSIONS

Diversity is a distinctive feature of European agriculture, and this is also reflected in the size of farms [17, 19]. In countries such as Belgium, Germany, Denmark, Estonia, France, Luxembourg, the Netherlands and Sweden, the share of farms with areas between 0-4.9 ha is lower, below 20%. This may suggest a trend towards larger, more mechanized and intensive farms in these countries, which may benefit from economies of scale [3].

In contrast, countries such as Bulgaria, Greece, Spain, Croatia, Italy, Cyprus, Hungary, Poland, Portugal and Slovenia have a higher share of small farms (0-4.9 ha), perhaps indicating a greater presence of family farming and subsistence [4, 5].

In particular, Cyprus (87.52%) and Portugal (73.39%) have a very high share of these small farms.

In the case of Romania, over 90% of farms have surfaces between 0-4.9 ha, the highest proportion among all the countries listed. This reflects a distinctive feature of Romanian agriculture, where small and very small farms, often subsistence or semi-subsistence, dominate the agricultural landscape [25].

Although these farms contribute to the maintenance of biological diversity and food security at the local level, they often face challenges related to productivity, market access and long-term sustainability [14, 16]. Therefore, the structure of farms and its evolution is a key issue for rural development and agricultural policies in Romania [20].

Romania has an agricultural sector dominated by small holdings, generally characterized by low economic efficiency.

Similarly, in Cyprus, 87.52% of farms are between 0-4.9 ha, suggesting a similar reliance on small-scale agriculture.

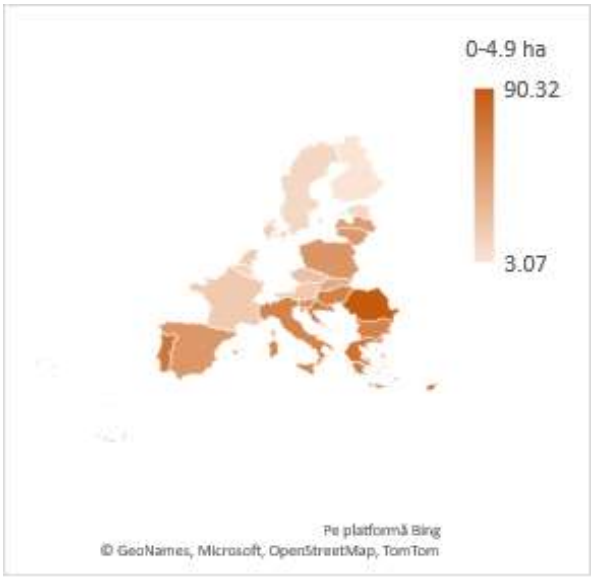


Fig. 1. The Share of farms with areas between 0-4.9 ha at the European level

Source: Own representation based on Eurostat data, 2023 [7].

In contrast, large farms, with areas over 100 ha, represent only 0.47% of the total in Cyprus and 0.55% in Romania.

On the other side, in countries such as France and Luxembourg, a significant share of large farms is observed. In France, farms with an area of more than 100 ha represent 26.14% of the total, while in Luxembourg, this percentage is even higher, reaching 27.66%. These countries have more developed and industrialized agricultural sectors, with large farms that can benefit from economies of scale and advanced technologies [2]. Germany shows a more balanced distribution of farms across size categories. The largest category is that of farms with 20-29.9 ha, which represents 20.01% of the total, followed by that of farms with 50-99.9 ha (17.03%). However, Germany also has a significant proportion of farms over 100 ha, at 14.52%, indicating a high diversity of farm structure.

In Bulgaria, although a large proportion of farms (64.03%) are small, with 0-4.9 ha, there is still an unexpectedly high percentage of farms over 100 ha, 5.75%, which suggests a trend of growth of large farms at the expense of small ones (Table 1).

Table 1. The Share of farms at the European level by farm size class (ha)

| | 0-4.9 ha | 5-9.9 ha | 10-19.9 ha | 20-29.9 ha | 30-49.9 ha | 50-99.9 ha | ≥100 ha |
|---|---|---|---|---|---|---|---|
| **Belgium** | 13.53 | 13.00 | 17.53 | 12.44 | 17.08 | 18.86 | 7.56 |
| **Bulgaria** | 64.03 | 9.21 | 7.39 | 4.29 | 5.01 | 4.32 | 5.75 |
| **Czechia** | 25.25 | 15.19 | 14.87 | 8.02 | 8.89 | 10.48 | 17.30 |
| **Denmark** | 18.71 | 18.58 | 14.80 | 8.01 | 9.01 | 11.22 | 19.68 |
| **Germany** | 8.17 | 17.04 | 20.01 | 9.53 | 13.70 | 17.03 | 14.52 |
| **Estonia** | 10.38 | 25.59 | 19.88 | 8.80 | 9.15 | 9.15 | 16.97 |
| **Greece** | 74.04 | 13.39 | 7.02 | 2.54 | 1.92 | 0.90 | 0.20 |
| **Spain** | 51.55 | 14.42 | 11.32 | 5.51 | 5.58 | 5.52 | 6.10 |
| **France** | 19.65 | 8.72 | 9.41 | 6.15 | 10.11 | 19.82 | 26.14 |
| **Croatia** | 70.61 | 14.83 | 7.09 | 2.43 | 2.22 | 1.79 | 1.04 |
| **Italy** | 64.11 | 14.13 | 9.67 | 3.98 | 3.63 | 2.87 | 1.61 |
| **Cyprus** | 87.52 | 5.90 | 3.05 | 1.17 | 1.06 | 0.88 | 0.47 |
| **Latvia** | 46.96 | 19.12 | 14.37 | 5.35 | 4.73 | 4.06 | 5.42 |
| **Lithuania** | 50.17 | 19.90 | 12.92 | 4.66 | 3.86 | 4.10 | 4.38 |
| **Luxembourg** | 16.49 | 8.51 | 8.51 | 5.32 | 9.04 | 25.00 | 27.66 |
| **Hungary** | 64.89 | 11.82 | 8.42 | 3.55 | 3.48 | 3.44 | 4.41 |
| **Netherlands** | 19.95 | 13.09 | 15.39 | 10.64 | 17.14 | 17.97 | 5.85 |
| **Austria** | 20.81 | 17.00 | 23.00 | 13.71 | 14.52 | 8.81 | 2.17 |
| **Poland** | 52.29 | 21.70 | 14.79 | 4.71 | 3.41 | 2.03 | 1.08 |
| **Portugal** | 73.39 | 11.19 | 6.54 | 2.41 | 2.12 | 1.91 | 2.44 |
| **Romania** | 90.32 | 5.58 | 1.95 | 0.63 | 0.59 | 0.39 | 0.55 |
| **Slovenia** | 61.94 | 21.58 | 10.97 | 2.93 | 1.66 | 0.76 | 0.19 |
| **Slovakia** | 39.94 | 18.59 | 12.63 | 5.60 | 5.40 | 5.20 | 12.68 |
| **Finland** | 3.07 | 13.46 | 19.31 | 13.48 | 17.40 | 20.27 | 13.04 |
| **Sweden** | 10.75 | 25.17 | 20.22 | 9.27 | 9.78 | 11.16 | 13.68 |

Source: Eurostat, 2023 [6].

European agriculture is diverse and extensive, with a wide range of specializations reflecting the continent's geographical and climatic variety. In 2020, there were more than 1.6 million farms specializing in general field crops, representing a significant proportion of all farms in the EU. This is an indication of the central role of these crops in European agriculture.

Farms specializing in "cereals, oilseeds and protein crops" also constitute a major category, with more than 1.4 million farms registered in 2020. This underlines the importance of these crops for human and animal nutrition in Europe.

Farms specialized in olive cultivation, with almost 884,000 units, represent another important category, reflecting the relevance of this culture in certain regions of the EU, especially in the Mediterranean countries [27].

The number of farms specializing in fruit and citrus, vines, various permanent mixed crops and horticulture is also notable, ranging from approximately 200,000 to 500,000.

This indicates the diversity of EU agricultural production and the relevance of these sectors to rural economies.

When it comes to animal husbandry, there are several farms specializing in dairy (about 466,000), raising and fattening cattle (about 385,000), and raising sheep, goats and other grazing animals (about 328,000).

The number of farms specializing in raising pigs and poultry is significantly smaller, but still important.

There are also significant numbers of mixed crop and livestock farms (about 895,000) as well as farms specializing in mixed crops (about 464,000).

This underlines the existence of mixed production systems in EU agriculture.

In conclusion, the diversity of specialist farms in the EU reflects a wide range of production systems, responding to different market demands, climatic and geographical conditions, as well as farmers' preferences and capacities (Figure 2.).

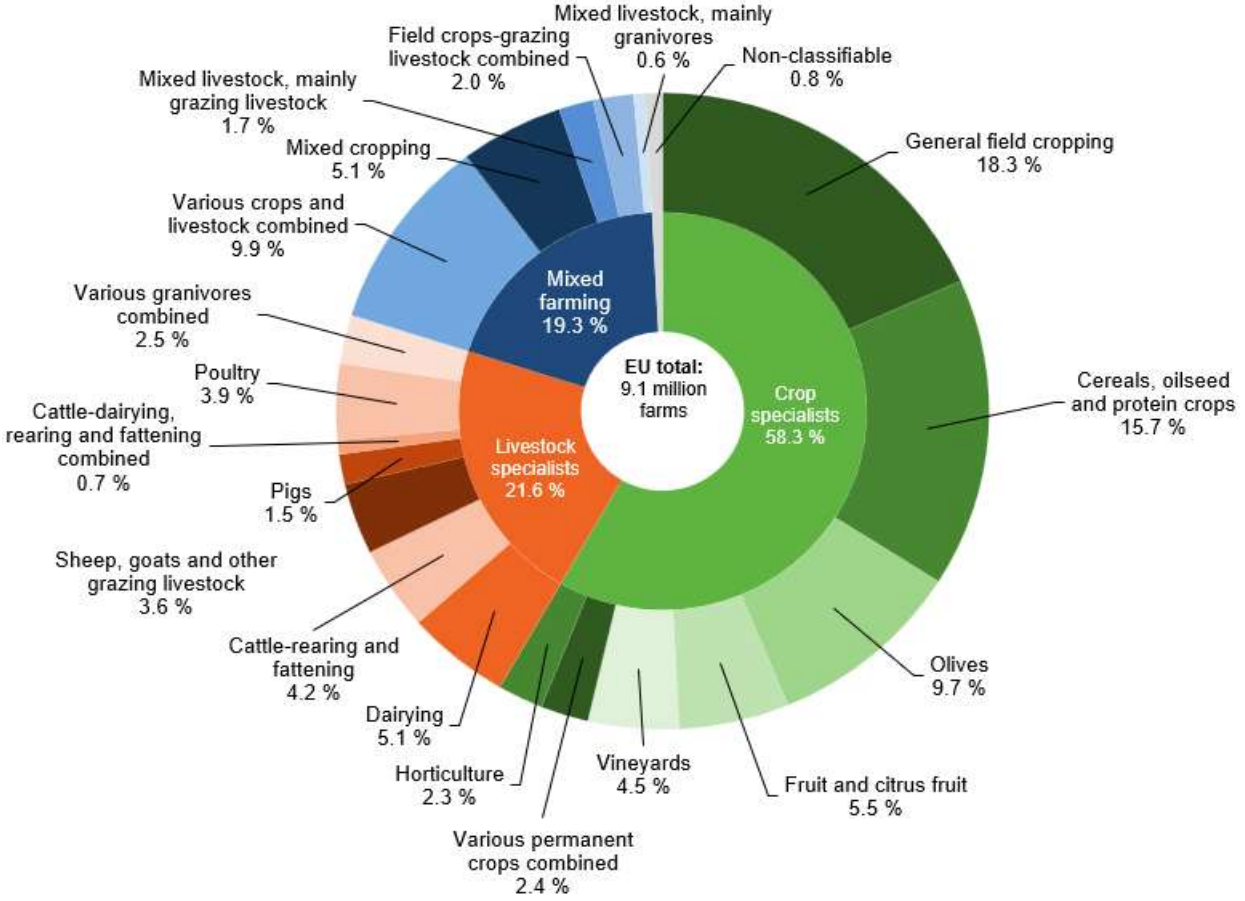


Fig. 2. Farms by type of specialisation (share of all EU farms, %, 2020)
Source: Eurostat, 2023 [6].

## CONCLUSIONS

Concluding the analysis of the presented data, it was noticed that the agricultural structure of the countries of the European Union is extremely diverse, reflecting the traditions, economy, geographical conditions, agricultural policy and many other aspects specific to each nation.

Countries such as Romania, Greece and Cyprus are dominated by small farms, reflecting a greater reliance on subsistence agriculture and often lower economic efficiency [1].

In contrast, countries such as France, Luxembourg and Denmark have a significant share of large farms, showing a more industrialized agriculture with high economic efficiency due to economies of scale and advanced technologies.

Countries such as Germany have a diverse agricultural structure, with a balanced distribution of farms across different sizes, possibly reflecting greater adaptability to market demands and changes within the agricultural sector.

In any case, the significant variations in the agricultural structure between the countries of the European Union underline the need for agricultural policies at EU level that take these differences into account and provide support adapted to the specific needs of each country.

In addition, these data indicate the need to continue and intensify efforts to modernize and improve efficiency in the agricultural sector in many regions of the European

Union, especially in countries with a high share of small farms.

Transforming these farms into more productive and sustainable holdings can have a significant impact on economic development, food security and environmental protection at European level.

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# ORGANIC SWEET POTATO PRODUCTION AND MARKETING IN ROMANIA – A CASE STUDY ON CHALLENGES AND OPPORTUNITIES

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***Abstract***

*In Romania, demand for organic food has surged since the pandemic began in the spring of 2020. Healthy growth is expected to continue in the coming years as consumers associate organic foods with good health, nutrition, and wellness. The complex challenge of protecting ecosystems while sustainably feeding the global population has attracted increasing attention in recent years and the need for improving food production and consumption led to the development of this field. The present study represents a comparative economic analysis of the sweet potato crop in a conventional and organic system. Data on production costs (materials, labour, mechanical works) as well as data on the commercialization of production, including preparatory activities for marketing (packaging, marketing conditioning) were taken into account. Following the analysis, cost efficiency proposals are highlighted in order to improve the producer's economic performance.*

***Key words*****:** *organic agriculture, sweet potato, sustainable food, protecting ecosystems, Romania*

## INTRODUCTION

In Romania, over the course of 10 years, from 2011 to 2021, the market for organic products grew four times, rising from 10.16 to 40.5 million euros [8]. Increased interest in organic products is the result of a mixture of factors, including Romania's growing economy, a greater focus among retailers on green products, and increased awareness among consumers of healthy food and the environment.

Sweet potato (*Ipomoea batatas* L.) plays an old and important role in food culture worldwide, being a highly nutritious vegetable species that surpasses most carbohydrate foods in terms of vitamin, mineral, dietary fiber and protein content [20, 3, 1, 19]. Sweet potatoes are cultivated on more than 9 million ha. The corresponding yield is about 124,000 thousand tons, while the average yield is about 13.7 tons/ha [6].

The developing countries are the main cultivators of sweet potatoes, covering over 97% of world output of which more than half representing 4.7 million ha (52%) is cultivated in China.

The rest of Asia accounts for 6 percent, Africa 5 percent, Latin America 1.5 percent, and the United States 0.45 percent. Vietnam is the second largest producer.

The largest European producer is Portugal with only 0.02 percent of world production [6, 7].

Yields differ across regions and, sometimes depending on climate conditions, even fields in the same location [10]. According to Faostat data the average yield in African countries account for 4.7 tons/ha, with yields of, 8.9 tons/ha in Kenya, 4.3 tons/ha Uganda,

tons/ha 2.6 Sierra Leone, and 6.5 tons/ha Nigeria, respectively. In the same tine, in Asian region, the yields resulted are significantly higher, with an average of 18.5 tons/ha as follows: China 20 tons/ha, Japan 24.7 tons/ha, Korea 20.9 tons/ha, Thailand 12 tons/ha. Israel gives the highest yields of 33.3 tons/ha. In South America, the average yield for 2017-208 was 12.2 tons/ha, with Argentina, the lead with 18 tons/ha, respectively. For comparison, the average yield in the US is 16.3 tons/ha (all data are averages for 2017 and 2018 from the FAOSTAT (2019) [7].

Sweet potatoes vary enormously in taste, size, shape, and texture. Sweet potato flesh can be white, orange, yellow, purple, red, pink, and violet, while skin color varies among yellow, red, orange, and brown.

Like in the case of other crops, the profitability of sweet potato production is closely related to yield and the sales price [9, 14, 2, 13]

For several years, intensive work has been conducted by the Research and Development Station for Plant Culture on Sandy Soils Dabuleni (SCDCPN Dabuleni) in order to introduce this plant into the Romanian climate and soil conditions [5]. In a temperate climate, this species is an annual plant, with high adaptability and resistance and has the potential in becoming an alternative crop in South Romania [4].

Tubers, rich in nutrients, are consumed after cooking, frying, or baking, whereas aerial parts can be used as valuable feed for animals or raw material for bioethanol or biogas production [14].

Sweet potato tubers also have high technological potential. In developing countries, all parts of this plant are valued and used in multiple sectors of the food and pharmaceutical industries [17, 11, 16].

According to [12] as well as [15], the sweet potato is a vegetable with broad applicability, mainly used to enrich the everyday diet, as well as a valuable medicinal plant with anti-inflammatory, anti-cancer and anti-diabetic properties, which can be a valuable raw material for the pharmaceutical industry. Sweet potato tubers can also be used in food processing to produce sugar, flour, pasta, desserts, alcohol, and thanks to a high content of vitamins, macro-, and microelements, supplements can be produced.

There are still no up-to-date studies of the production costs of sweet potatoes.

Therefore, the aim of this research was to assess the cost of sweet potato production and sales in Romanian soil, climate, and market conditions.

## MATERIALS AND METHODS

The study areas were Dăbuleni Research and Development Station for Plant Cultivation on Sandy Soils (SCDCPN Dăbuleni) in Dolj County for a conventional system and an Organic certified farm from Vâlcelele, Călărași County.

The sweet potato field cultivation technology developed by SCDCPN Dăbuleni in 2018 was applied Diaconu et al. (2018) [4], the density of planting being 40,000 plants/hectare in the conventional system, respectively 35,000 plants/hectare in the organic system.

For the economic analysis were taken into account the production, costs, and prices related to the year 2022. The sweet potato line *DK 19/1*, originating from SCDCPN Dăbuleni, was used as biological material, a genotype characterized by high productivity, white flesh, very sweet, reddish tuberous root skin, with increased tolerance to specific pathogens.

Both locations were equipped with weather stations from which the data related to the sweet potato vegetation period were processed (May 27 - September 20 for the ecological system, respectively May 10 - September 10 for the conventional system).

The soil analyses performed in the biochemistry laboratory of SCDCPN Dăbuleni consisted of determinations of soil pH, organic carbon (%), total nitrogen (%), extractable phosphorus (ppm), exchangeable potassium (ppm), (Table 1), using the following methods:

- total nitrogen – Kjeldahl method;
- extractable phosphorus (P-AL) - the Egner - Riem Domingo method, by which phosphates are extracted from the soil sample with an

acetate - ammonium lactate solution at pH - 5.75, and the extracted phosphate anion is determined colorimetrically as - blue of molybdenum;
- exchangeable potassium (K-AL) – the Egner - Riem Domingo method by which the hydrogen and ammonium ions of the extraction solution replace the potassium ions in exchangeable form from the soil sample which are thus passed into the solution. The dosage of potassium in the solution thus obtained is done by flame emission photometry.
- organic carbon – method of wet oxidation and titrimetric dosing (according to Walkley – Blak in Gogoaşa modification);
- soil pH, potentiometric method.
The economic efficiency analysis consisted of the calculation of effort, effect, and economic efficiency indicators. Effort indicators were calculated such as expenses per hectare (Ch/ha), expenses with the labor force, materials, mechanical works, irrigation, delivery expenses, as well as certification expenses. The effect indicators were reflected by income per hectare and those of economic efficiency by the cost per product unit (C), labor productivity (W), total profit, profit rate (Rp), and expenses per 1,000 lei of income (Ch/1,000 lei income).
For both culture systems, the profitability threshold was also calculated, an indicator capable of providing synthetic information to support farmers' strategic decisions regarding the introduction or expansion of sweet potato cultivation.

$$Qpr = \frac{CF}{p-cuv} \quad \text{.....(1)}$$

where:
Qpr = the physical volume of production at the break-even point;
CF = fixed costs;
p = unit price;
cuv = variable unit cost.

## RESULTS AND DISCUSSIONS

Consumption of sweet potatoes in Romania is on a positive trend for the last decade, both as raw material and processed (Figure 1).

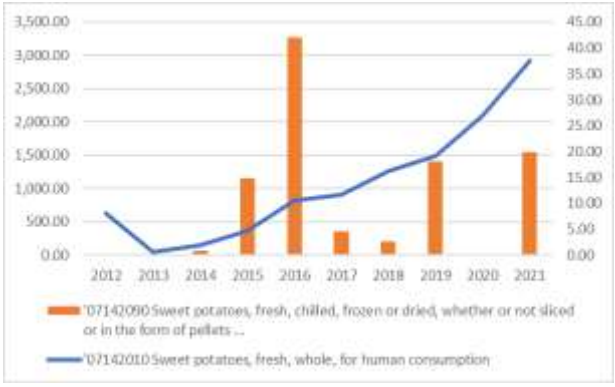


Fig. 1. Quantities (thousand kg) imported in Romania for sweet potato
Source: Trade map data [18].

In 2021, Romania was importing a quantity of sweet potatoes of over 2,900 tons. The main supplying markets were Germany, Egypt, and the United States (Figure 2).
Although import data show that there is demand for this product, in Romania this crop is not so much cultivated.

Fig. 2. Main supplying markets for sweet potatoes in Romania, 2021
Source: Trade map data [18].

Fig. 3. The geographical location of the two case study areas
Source: authors own contribution.

The most important supplier of planting material is SCDCPN Dăbuleni, one of the locations studied in this article.

The two case study areas are both located in Southern Romania, as plotted in Figure 3.

Sweet potatoes in the conventional system at the SCDCPN Dăbuleni are cultivated on sandy soil with low natural fertility. The crop in the organic system from Vâlcelele, Călărași County are cultivated on fertile soil of chernozem type.

Location, soil, and climate characteristics of the case study areas of sweet potato are presented in Table 1.

Table 1. Location, soil, and climate characteristics of the case study areas of sweet potato

| Analyzed parameters | Organic certified farm | SCDCPN Dabuleni |
|---|---|---|
| Longitude | $27^{o}\ 00^{I}\ 09^{I}\ 55^{II}$ | $24^{o}06^{I}\ 81^{I}\ 26^{II}$ |
| Latitude | $44^{o}\ 00^{I}\ 22^{I}\ 42^{II}$ | $43^{o}80^{I}\ 03^{I}\ 40^{II}$ |
| Elevation (m) | 27 | 56 |
| Soil pH | 6.6 | 5.99 |
| Organic carbon (%) | 1.04 | 0.45 |
| Total nitrogen (%) | 0.1 | 0.05 |
| Extractable phosphorus (ppm) | 31 | 57.84 |
| Exchangeable potassium (ppm) | 58 | 32.00 |
| Precipitation (l/mp) | 125.7 | 151.4 |
| Average temperature ($^{o}$C) | 23.7 | 22.88 |
| Accumulated temperature (>15 $^{o}$C) | 2,764 | 2,854 |

Source: in house development.

### *Economic indicators*

Comparing the production achieved and the total expenses for the two cultivation systems, a major difference can be observed regarding the level of production, total production expenses as well as marketing expenses. Regarding the production per hectare, in the organic system, the yield obtained was about 10,555 kg/ha, in the conventional system 20,000 kg/ha were obtained (Figure 4).

The main reason for this difference was the administration of chemical fertilizers. Regarding the total production expenses, they are higher within the analyzed conventional system.

Conversely, the marketing expenses for the selling of the production were approximately 96 % higher in the case of organic production. This difference was made up of a series of raw materials necessary for packaging (organic fruits and vegetables are sold packed if the retailer in which they are sold sells conventional products also) in such as micro-perforated bags, labels, crates, packing manual labor, and delivery expenses etc.

The cost of production, the last indicator analyzed, which represents the costs incurred to obtain a unit of product, shows a higher value in the case of the organic production system.

Thus, if in the conventional system, the production cost was 2.1 lei/kg, in the organic system it was higher, reaching 3.5 lei/kg. Analyzing the structure of the production cost in the organic system, it was found that the expenses for raw materials and materials have the largest weight, followed by the expenses with the labor force and the expenses with the irrigation.

At an average production selling percentage of approximately 90-91%, the total revenues obtained were 90,000 lei for the conventional culture system and approximately 79,900 lei for the organic system.

The average sales price obtained after negotiating with the different retailers, during the 2022 marketing year, was 8.3 lei/kg in the case of the organic system and 5 lei/kg in the conventional one.

The analysis of the profit and the profit rate revealed a net advantage for the production under organic area. This advantage was unquestionably caused by the considerably higher sale price.

Thus, if in the conventional system, the achieved profit was around 28,555 lei/ha, in the case of the organic production system, it reached the value of 32,469 lei/ha, with approximately 13.7% higher (Figure 5).

Obviously, the profit rate also kept the same superiority advantage, being 19% higher, from 68.9% in the conventional system to 87.9% in the organic system.

Labor productivity is another important indicator, which reflects the effectiveness of labor spent in the production process and is determined as a ratio between the output obtained and the amount of labor used. In the present case, a higher productivity is found in the conventional production system since a large part of the work is performed mechanized. Thus, if in the ecological production system the value of labor productivity was 669 lei/MD, that is, an 8-hour norm brought an income of 669 lei, in the case of the conventional system, the value reached 1,000 lei/MD.

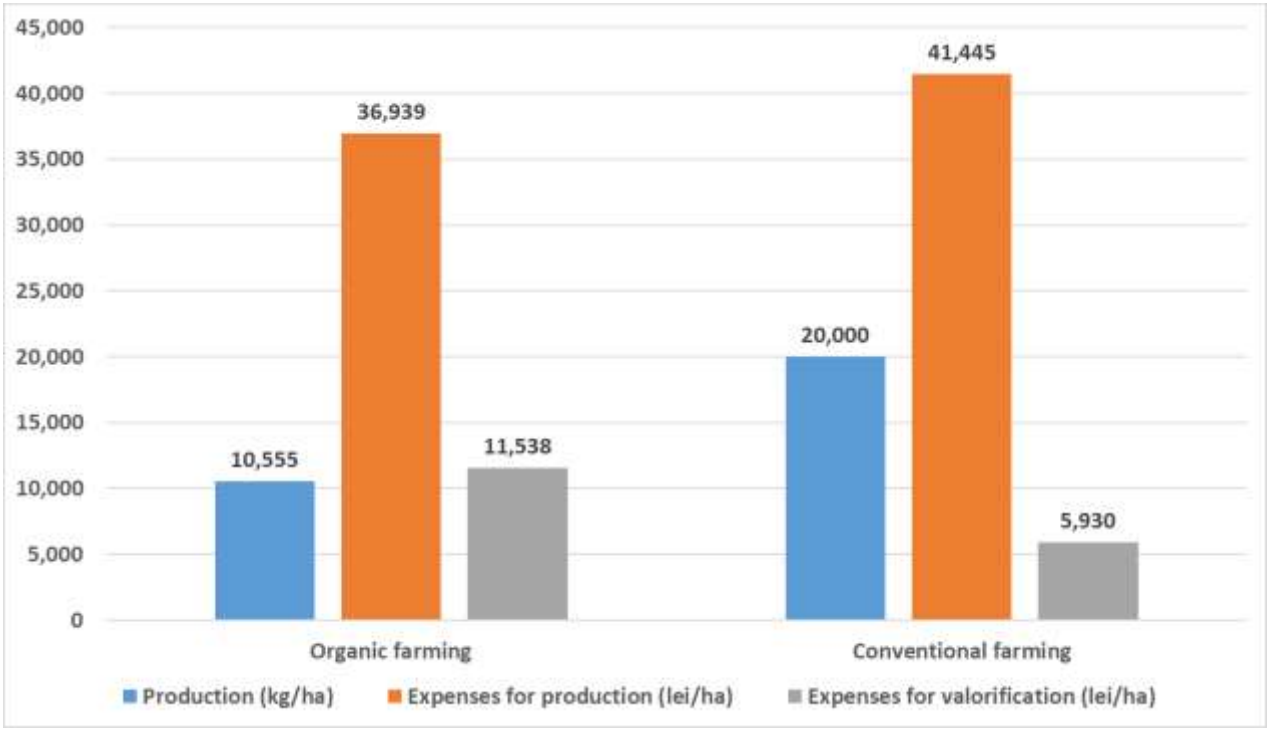


Fig. 4. Comparison of production vs expenses for organic vs conventional production system
Source: in house development.

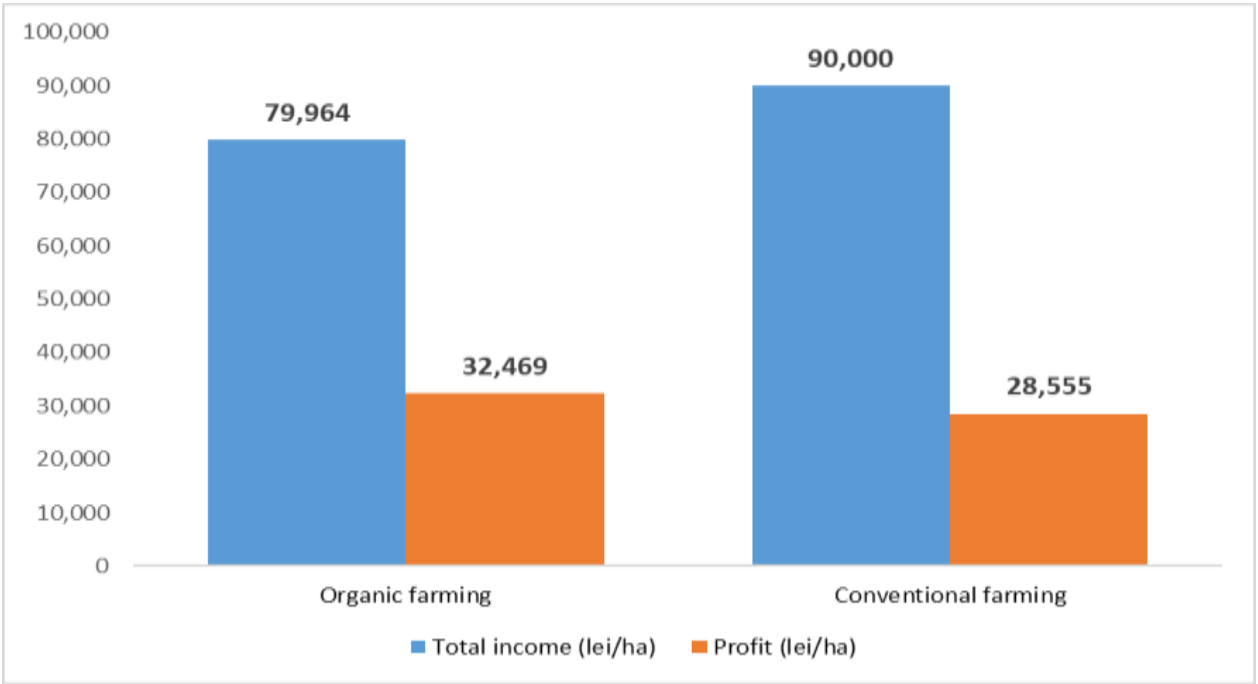


Fig. 5. Comparison of revenues vs profit for organic vs conventional production system
Source: in house development.


Photo 1. Organic (a) vs conventional (b) production system – aspects from experimental fields
Source: in house development.

Table 2. Comparative economic indicators

| Indicators | M.U. | Organic System | Conventional System |
|---|---|---|---|
| Yield | Kg/ha | 10,555.0 | 20,000.0 |
| Production costs | Lei | 36,939.5 | 41,445.0 |
| Production marketing costs | Lei | 11,538.0 | 5,930.0 |
| Percentage of the production sold | % | 90.90 | 90.00 |
| Market price | Lei/kg | 8.35 | 5.00 |
| Total work force | Days | 119.50 | 90.00 |
| Total income | Lei | 79,963.8 | 90,000.0 |
| Profit | Lei | 32,469.3 | 28,555.0 |
| Profit rate | % | 87.90 | 68.90 |
| Work force productivity | Lei/Day | 669.15 | 1,000.0 |
| Profitability threshold | Kg/ha | 4,434.51 | 8,289.0 |
| Unitary production cost | Lei/kg | 3.50 | 2.05 |

Source: in house development.

The break-even point represents the point at which the revenue collected from the sale of the production fully covers the expenses related to the realization of the production, being the point from which any additional income will generate profit.In the present case, the value of the profitability threshold obtained in the conventional system was 8,289 kg, and in the organic system it was 4,434 kg, which means that the difference to the total production achieved represents the profit. The detailed indicators dashboard is presented in Table 2.

***Marketing channels***

The marketing channels of the two study cases, differ, as well. The conventional farm is selling the production to a retail supermarket chain, only in loose packing.

The organic farm is selling to multiple retailers and buyers, in various packing variants (Figure 6).

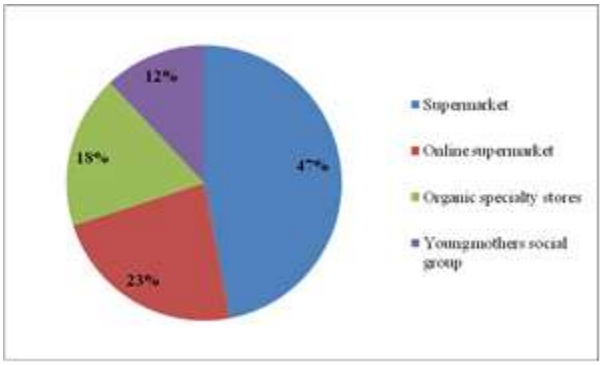


Fig. 6. Qunatities sold by the organic farm, by packing categories
Source: in house development.

Most of the production went to the supermarkets, be it online (23%) or physical stores (47%) The organic specialty stores represent almost 20% of the sales share of the organic farm. An important share is sold to an informal channel, namely a young mothers social group as shown in Fig. 7.

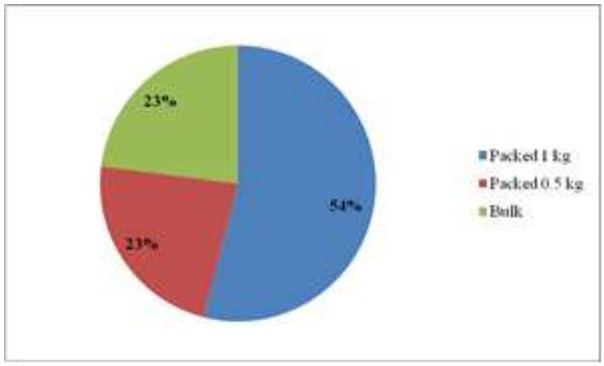


Fig. 7. The share of sales for organic farm by product category
Source: in house development.

The farmer is delivering to this market segment almost 12% of the production, returning 5% of income. The products sold to this channel are second grade quality and half-price. Thus, in addition to a greater diversity of conventional sales channels used in the case of the analyzed organic farm, we also note an approach that considers social awareness of the relevance of purchasing organic products found within certain consumers groups.

It is well known the fact that fruits and vegetables first-grade quality marketing standards may cause economic loses, especially for organic producers, because a part of the harvested crops may not be sold by conventional trading channels due to criteria such as, among others, appearance, and conformation.

Therefore, in addition to a strong commitment to environmental issues, it is equally important for organic producers to be able to target different segments of consumers for which nutritious and healthy criteria prevail rather than appearance and size standards.

In order to develop a more effective marketing approach for organic producers, consumer perception of the benefits and values of organic products as well as government support to increase public awareness should be explored in future research.

## CONCLUSIONS

Selecting a variety of species and plant varieties with high adaptability to climatic and soil conditions is required to achieve high, safe, and stable productions in the context of market and climate change. Romania has a lot of potential for sweet potato farming. It produces a good yield per hectare, and market demand is rising. The introduction of the newest cultivation technologies into production must be supported by economic efficiency calculations that provide the opportunity to select the best technological options, capable of ensuring high production per surface unit, of superior quality, with minimal production costs and workforce consumption. The organic system is a good production niche. Despite the lower production per acre than

Given that the selling price is greater and the costs are lower, even though the production per hectare is lower for the sweet potato system than for the conventional system, total profitability is higher for the sweet potato system.

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# THE EVOLVING STATE OF AGRI-FOOD SECURITY IN THE REPUBLIC OF MOLDOVA - A REVIEW

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***Abstract***

*Moldova faces substantial agri-food security challenges, including the availability, accessibility, and affordability of safe, nutritious food for its population. With high poverty rates and a large rural population relying on agriculture, Moldova's agricultural sector has small landholdings, low productivity, and insufficient investment in modern technologies. Climate change and extreme weather events have led to declines in agricultural production and increased dependence on imports for food needs. The recent COVID-19 pandemic and regional conflict in Ukraine have exacerbated food insecurity, causing rising food prices and reduced availability. This paper uses a SWOT framework to analyze Moldova's agri-food security, identifying areas for improvement and potential strategies for enhancing resilience and sustainability. Findings emphasize the importance of integrated, multi-sectoral approaches, promoting sustainable agricultural practices, investing in modern technologies, and fostering collaboration among the government, international organizations, and stakeholders. By addressing these challenges and leveraging opportunities, Moldova can improve the long-term resilience and competitiveness of its agri-food sector while ensuring food security for its population.*

***Key words*****:** *agri-food sector, Republic of Moldova, sustainable agriculture, supply chain, comprehensive approach*

## INTRODUCTION

Agriculture is an important sector of the economy in the Republic of Moldova assuring jobs, income, agri-food products for the internal market and export.

The development of agro-food sector is closely linked to Moldova's foreign trade and the last decade is characterized by important changes both regarding export and import structure of agro-food products [2].

The promotion of agricultural products trading in order to increase the efficiency of the agricultural sector [3].

Infrastructure plays a very important role in assuring agri-food products quality [4].

For this reason, investments are required to strengthen the agricultural sector and increase the profitability of the products and encourage cross border cooperation [1].

Increasing products quality have a favourable impact the growth of profitability, labor productivity and competitiveness [7].

Innovative activity represents an indispensable factor of performance in the agrofood sector [10].

Agri-food security plays a pivotal role in ensuring a nation's welfare and fostering sustainable development, particularly in the context of globalization, environmental shifts, and demographic expansion. As a country whose economy predominantly relies on agriculture, the Republic of Moldova encounters a unique set of challenges and prospects in its pursuit of agri-food security.

In this comprehensive review, we delve into the intricacies of agri-food security in the Republic of Moldova, shining a light on the primary factors that have molded its progression and the contemporary obstacles confronting the agri-food industry. The impetus behind this investigation is to gain a deeper understanding of Moldova's agri-food security concerns and provide valuable insights for devising effective policy measures in this domain.

The recent transformations in the economic, social, and political spheres, alongside climate-related and geopolitical vulnerabilities, underscore the significance of exploring agri-food security within the context of the Republic of Moldova. These factors, along with advancements in technology, market demands, and consumption patterns, greatly impact agri-

food security and the competitiveness of Moldova's agri-food sector.

This article examine various sources, including government reports, studies, statistical data, scientific publications, and documents from international organizations, to identify main trends, challenges, and government policies and strategies implemented to ensure food security in Moldova.

During 2021-2022, Moldovan agriculture encountered multiple challenges, including a severe drought, soaring fertilizer and diesel prices, high agricultural credit interest rates, and loss of access to markets in Russia, Belarus, and Ukraine. Small farmers and household backyard producers were most affected by these adversities. In 2022, cereal production fell significantly below the five-year average, with maize and wheat production experiencing the greatest declines. Oil crops and pulses also saw reduced production levels, leading to concerns about livestock, rising input costs, and food prices.

Utilizing the information and perspectives presented, this article aims to enhance comprehension of the elements impacting agri-food security in the Republic of Moldova and pinpoint potential opportunities as well as obstacles for the agri-food industry. Our intention is for our assessment to function as a useful asset for decision-makers, professionals in the agri-food domain, and the scholarly community, as they strive to ameliorate agri-food security and encourage sustainable growth in the Republic of Moldova.

## MATERIALS AND METHODS

This article serves as a review paper addressing the development of agri-food security in the Republic of Moldova. The methodologies and materials employed primarily revolve around the examination of secondary data and the integration of pre-existing information. Sources include governmental reports and studies on agri-food security and agricultural policies within the Republic of Moldova; official statistics published by the National Bureau of Statistics and other pertinent institutions; and documents from international organizations like the FAO, World Bank, and European Union.

Additionally, an analysis and synthesis approach was utilized, encompassing a comparative investigation of agri-food security developments in the Republic of Moldova alongside other regional countries. To offer a comprehensive perspective on the key factors affecting agri-food security within the Republic of Moldova, a SWOT analysis was conducted.

## RESULTS AND DISCUSSIONS

*Comparative examination of the development of agri-food security in the Republic of Moldova in relation to neighboring countries in the region (Ukraine and Romania)*

The comparative analysis of the evolution of agri-food security in the Republic of Moldova with other countries in the region, such as Romania, Ukraine and other Eastern European and Balkan countries, can be made by examining several relevant indicators, such as agricultural production, access to food, food stability and sustainable use of natural resources.

**Agricultural production**

According to FAO (2022), The Republic of Moldova is a predominantly agrarian economy, with the agricultural sector contributing about 10.2% of GDP [6].

In comparison, agriculture accounts for 4.3% of Romania's GDP [5, 12] and 9.63% of Ukraine's GDP [11]. Although Moldova has diversified agricultural production, including cereals, vegetables, fruit and vines, productivity is relatively low compared to neighbouring countries such as Romania and Ukraine due to outdated technologies and lack of investment in the sector [5, 12 ].

**Access to food**

Access to food is a crucial aspect of agri-food security. In the Republic of Moldova, the prevalence of malnutrition has declined in recent times, yet it continues to be more elevated in comparison to neighboring countries in the region, such as Romania.

Rural poverty and fluctuations in food prices can have a negative impact on access to quality food in sufficient quantities for some population groups.

**Food stability**

Food stability means constant availability of food for the population. The Republic of Moldova faces challenges related to food stability due to climate change and vulnerability to natural disasters such as droughts or floods. In comparison, Romania and Ukraine have better food stability due to a more developed agricultural sector and more effective risk management policies.

**Sustainable use of natural resources**

In Moldova, soil degradation, water pollution and deforestation affect the sustainability of the agricultural sector.

Contrastingly, neighboring countries in the region, like Romania, have instituted more successful policies and tactics to safeguard the environment and foster sustainable agriculture.

While the Republic of Moldova has seen enhancements in agri-food security in recent times, it continues to trail behind nearby nations, including Romania and Ukraine.

To boost agri-food security and match regional benchmarks, the Republic of Moldova must tackle critical obstacles such as subpar productivity, restricted food accessibility for certain demographic groups, food stability, and the sustainable management of natural resources.

This can be achieved by investing in modern and innovative technologies, implementing effective policies and strategies for risk management and developing a sustainable agriculture that is competitive with other countries in the region.

The SWOT analysis, illustrated in Table 1, offers an all-encompassing perspective on the strengths, weaknesses, opportunities, and risks associated with agri-food security in the Republic of Moldova. This analysis highlights the crucial elements and obstacles influencing the development of the sector and food security within the nation.

Table 1. SWOT Analysis of Agri-food Security in the Republic of Moldova

| **Strengths (S)** | **Weaknesses (W)** |
|---|---|
| 1. Abundant natural resources, including fertile soils and a favorable climate for agriculture.<br>2.Agricultural tradition and experience in agri-food production.<br>3.Diversity of crops and agri-food products.<br>4.Potential for increasing agricultural productivity through the adoption of modern technologies and practices.<br>5.Proximity to European markets and potential for developing exports. | 1.Underdevelopment of rural infrastructure, including roads, irrigation and storage systems.<br>2.Limited access to finance and resources for farmers and agribusinesses.<br>3.Low degree of mechanisation and technology in the agricultural sector.<br>4.Lack of cooperation and organisation between farmers and agri-businesses (weak and fragmented logistics chains).<br>5.Insufficient investment in research and development in the agri-food sector. |
| **Opportunities (O)** | **Threats (T)** |
| 1.increase the level of technological innovation and digitisation in the agri-food sector.<br>2.Exploiting export potential and market diversification.<br>3.Adoption of sustainable agricultural practices and efficient use of resources.<br>4.Public-private cooperation and partnerships for the development of infrastructure and services in rural areas.<br>5.Improve agricultural and rural development policies in line with national and international objectives.<br>6.Effective capacity to implement the EU Farm to Fork Strategy. | 1.Climate change and its impact on agricultural production and natural resources.<br>2.Price volatility on international markets and vulnerability to economic shocks.<br>3.Increasing demographic pressure and global food demand.<br>4.International competition in the agri-food sector and difficulties in accessing external markets.<br>5.The spread of diseases and pests in the agricultural sector and risks to food safety and public health.<br>6.Political instability in the region: may create economic uncertainty, affect investment and development in the agri-food sector, and lead to delays in the implementation of reforms and development projects. |

Source: Elaborated by the authors.

*Evolution of agri-food security in the Republic of Moldova*

## Historical trends and major current challenges

Following its attainment of independence in 1991, the Republic of Moldova experienced a challenging phase of economic transition, which had a substantial impact on the agri-food sector. In the 1990s and early 2000s, agricultural production declined steadily, driven by problems such as land redistribution, lack of investment and inefficient irrigation systems. In the last decade, there have been significant improvements in agricultural production, but the sector still faces major challenges.

In recent years, the Republic of Moldova has seen an increase in the production of cereals, pulses and oilseeds, according to data published by the National Bureau of Statistics, cereal production increased from 1.3 million tonnes in 2018 to 1.76 million tonnes in 2022. However, crop yields remain below the average level in the region, indicating the need for measures to increase efficiency and productivity [9].

Presently, the agri-food industry faces obstacles such as inadequate rural facilities, restricted financial accessibility for agriculturalists, reliance on exports to customary markets (like the Russian Federation), and vulnerability to climatic fluctuations.

## Agri-food security indicators

In the Republic of Moldova, agri-food security metrics encompass agricultural yield, food availability, quality and safety of food, as well as food consistency over time. Information released by the FAO indicates a reduction in the rate of undernourishment in the Republic of Moldova, dropping from 6.7% in 2018 to approximately 4.2% in 2022, signifying enhanced food access for the populace [6].

However, the Republic of Moldova remains vulnerable to external shocks, such as fluctuations in food prices on international markets and climate change. For example, in 2020, the severe drought experienced by the country affected cereal harvests, leading to a drop in production and higher food prices

## The influence of climate change on agri-food security

In Moldova, climate change poses a significant risk to agri-food security. It has the potential to directly impact agricultural output, food safety and quality, in addition to influencing food accessibility and long-term stability. The effects of climate change on agricultural production include changes in rainfall, temperatures and extreme weather events such as droughts and floods.

As stated in the Intergovernmental Panel on Climate Change (IPCC) reports, the Republic of Moldova is experiencing a rise in mean yearly temperatures and alterations in rainfall patterns. These shifts could lead to the subsequent consequences outlined in Table 2.

In order to cope with the effects of climate change on agri-food security, the Republic of Moldova needs to adopt an integrated and multi-sectoral approach. This can include promoting sustainable and climate-adapted agricultural techniques, improving irrigation systems, investing in agricultural research and innovation, developing rural infrastructure and strengthening the capacity of local communities to manage natural resources and adapt to climate change.

Table 2. Effects of Climate Change on Agri-Food Security

| Climate Change Impact | Explanation |
|---|---|
| Decreased crop yields | Rising temperatures and changes in rainfall can negatively affect crop yields, reducing agricultural production and threatening food security. For example, in 2020, a severe drought led to a drop in cereal production in the Republic of Moldova. |
| Changing growing cycles | Climate change can affect crop-growing cycles, which can lead to yield losses and reduced food security. |
| Increased incidence of diseases & pests | Climate change may favor the spread of diseases and pests, negatively affecting agricultural production and food quality. |
| Affecting irrigation systems | Alterations in the volume and dispersion of precipitation may adversely affect irrigation systems, essential for sustaining agricultural output and food stability in dry and semi-dry environments. |

Source: developed by the authors.

In order to cope with the effects of climate change on agri-food security, the Republic of Moldova needs to adopt an integrated and multi-sectoral approach. This can include promoting sustainable and climate-adapted agricultural techniques, improving irrigation systems, investing in agricultural research and innovation, developing rural infrastructure and strengthening the capacity of local communities to manage natural resources and adapt to climate change.

*Recommendations for the future of agri-food security in the Republic of Moldova*

**Strengthening agricultural and rural development policy**

It is crucial to strengthen agricultural and rural development policy by implementing coherent and effective strategies tailored to the needs and specificities of the Moldovan agri-food sector. This involves developing an appropriate legislative and regulatory framework, encouraging sustainable agricultural practices and promoting an integrated approach to rural development.

**Improving access to finance and investment**

Financial accessibility and investment play a crucial role in the growth of the agri-food industry. It is vital for governmental bodies and financial establishments to collaborate in devising funding mechanisms that cater to the requirements of agriculturalists and agri-food enterprises, including favorable loans, subsidies, or guarantee programs.

**Promoting cooperation and public-private partnerships**

Collaboration and public-private alliances hold considerable potential to advance the agri-food industry and bolster agri-food security. Such partnerships can promote technology and knowledge exchange, infrastructure enhancement, and market accessibility. By fostering these alliances, the Republic of Moldova can draw in capital and proficiency from the private domain for the collective benefit of the entire agri-food sector.

**Education and training in the agri-food sector**

Allocating resources to agri-food education and skill development is crucial for cultivating a proficient workforce that caters to the sector's demands. Government entities and educational institutions ought to collaborate in creating specialized agri-food training curriculums and classes that encourage innovation, the implementation of contemporary technologies, and resourceful utilization of resources.

**Adopt a framework for monitoring and evaluating agri-food security.** In order to ensure agri-food security in the Republic of Moldova, it is essential to adopt an effective and comprehensive monitoring and evaluation framework. This framework should be based on relevant indicators that allow for the assessment and comparison of performance over time and with other countries or regions.

*Opportunities and challenges for the Moldovan agri-food sector*

Table 3. Opportunities and Challenges for the Moldovan Agri-food Sector

| Opportunities and Challenges | **Description** |
|---|---|
| Technological Innovation and Digitalization | Embracing cutting-edge technologies, including precision farming, intelligent irrigation systems, and data-centric solutions, can enhance the effectiveness, productivity, and competitiveness of agricultural operations. Digitalization can simplify farmer access to information, amenities, and marketplaces, thereby boosting agri-food security. Nevertheless, investments in digital infrastructure and workforce education are required to tackle obstacles stemming from insufficient technological expertise and capabilities among agriculturalists. |
| Exploiting the export potential | The agri-food industry in Moldova possesses significant export capacity, particularly for value-added agricultural goods like wines and processed fruits and vegetables. Implementing a robust and varied export approach can elevate the revenue of the agri-food sector while decreasing reliance on customary markets. However, to realise this potential, Moldova needs to improve the quality and food safety of its products, comply with international standards and promote cooperation with trading partners. |
| Product and market | Diversification of agricultural products and markets is an opportunity and a |

| | |
|---|---|
| diversification | challenge for the Moldovan agri-food sector. Diversification can help reduce the risks and vulnerabilities associated with dependence on a limited number of products and markets. To this end, Moldova should invest in research and development, promote innovation and support the adoption of sustainable and competitive agricultural practices. |
| Sustainable development and resource efficiency | The agri-food sector in Moldova encounters obstacles concerning sustainable growth and the effective utilization of natural resources. To tackle these issues, Moldova needs to promote sustainable agricultural practices, responsibly manage water and soil resources and protect biodiversity and ecosystems. The implementation of appropriate policies and strategies in this area can contribute to increasing the resilience of the agri-food sector to climate change. |

Source: Elaborated by the authors.

## CONCLUSIONS

Based on this study, the following conclusions can be drawn:

-Agri-food security in the Republic of Moldova has made significant progress in recent decades, thanks to government efforts and international support.

-Climate change is a major challenge to agri-food security, affecting both agricultural productivity and the availability of and access to necessary resources.

-Government policies and strategies have been instrumental in strengthening the legislative and policy framework and promoting rural development and infrastructure.

-Opportunities for the Moldovan agri-food sector include technological innovation and digitisation, harnessing export potential, product and market diversification, and sustainable development and resource efficiency.

-Recommendations for the future of agri-food security in Moldova include strengthening agricultural and rural development policy, improving access to finance and investment, promoting public-private cooperation and partnerships, agri-food education and training, and adopting a framework for monitoring and evaluating agri-food security.

Finally, this review paper highlights the importance of an integrated approach and collaboration between different actors to ensure agri-food security and sustainable development in the Republic of Moldova.

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# GASTRONOMIC TOURISM IN THE REPUBLIC OF MOLDOVA - TRENDS AND OPPORTUNITIES

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***Abstract***

*In recent years, gastronomic tourism in the Republic of Moldova has gained momentum due to the country's rich culinary heritage and traditional dishes. The culinary culture of the Republic of Moldova is shaped by its history and geography, with influences from neighbouring countries Romania and Ukraine, as well as its history of being a part of the USSR. The Moldovan wine industry has also played a significant role in driving food tourism, with a long history of winemaking and numerous vineyards and wineries. Moreover, there is growing interest in agri-tourism, which offers visitors the chance to experience rural life and learn about traditional farming practices. Many small family farms in Moldova provide accommodations and activities such as cooking classes, farming activities, and vineyard visits. Despite the potential for food tourism, Moldova's food tourism industry has yet to reach its full potential. To attract more food tourists, promoting and marketing the country's culinary heritage and traditional dishes, as well as increasing the number of food-related events and activities, could prove beneficial. Gastronomy is an integral part of every community, representing a valuable tourism resource and an essential tool for destination image and branding. This paper aims to analyze the potential of Moldova's food tourism industry and provide recommendations for establishing and developing it further as an important pillar of the country's tourism industry. Moldova's ethnic and social diversity and indigenous communities influence its gastronomy, providing insights into ancient gastronomic traditions, customs, manners, and farming practices, making Moldova a unique and underdeveloped gastronomic tourism destination. Materials and methods: The authors apply a quantitative research approach, analyzing data from the National Bureau of Statistics of the Republic of Moldova to examine trends and opportunities in the country's gastronomic tourism. Various research methods, including analysis, comparison, grouping, and SWOT analysis, were employed. Main results: The findings reveal that Moldova's tourism industry was significantly impacted by the COVID-19 pandemic in 2020 but showed signs of recovery in 2021. The country's rural areas, wine industry, and culinary traditions offer unique opportunities for gastronomic tourism development. However, challenges such as lack of awareness, promotion, limited infrastructure, and low stakeholder collaboration need to be addressed. Conclusions: This study highlights Moldova's potential for gastronomic tourism development. To fully develop this industry, efforts should focus on promoting the country's culinary heritage, increasing food-related events and activities, improving infrastructure and services, fostering collaborations, and leveraging digital platforms. By addressing challenges and capitalizing on opportunities, Moldova can establish and further develop its food tourism industry, contributing to economic growth, job creation, and the promotion of its unique culinary heritage.*

***Key words*****:** *gastronomic tourism, culinary heritage, niche tourism, agri-touris, Republic of Moldova*

## INTRODUCTION

This article centres on the Republic of Moldova, a country where food consumption holds a significant role in society, yet the food tourism industry is relatively underdeveloped. The Moldavian culture and heritage place special emphasis on food and beverage attributes, reflecting the diversity of culinary traditions, local ingredients, and cooking techniques. Despite its rich gastronomic heritage, Moldova has yet to fully realize the potential of its food tourism industry. This article aims to explore the trends and opportunities of gastronomic tourism in Moldova and provide recommendations on how the industry can be established and further developed as a vital component of the country's tourism sector. By promoting the country's culinary heritage and traditional dishes and expanding the number of food-related activities and events, Moldova can

attract more food tourists and contribute to the economic growth of the tourism industry.

In addition to the importance of gastronomic tourism itself, it is essential to consider the future of food in the context of responsible production, acquisition, consumption, and disposition [22]. The sustainable development of gastronomic tourism in the Republic of Moldova requires addressing these aspects and integrating them into the industry's development strategies and practices. By promoting a sustainable and responsible food system, gastronomic tourism can contribute not only to economic growth but also to the protection of the environment and the promotion of a healthy lifestyle for tourists and locals alike.

Gastronomic tourism has gained popularity in recent years, as food has become an integral part of travel experiences. In the Republic of Moldova, gastronomy plays a significant role in the country's cultural identity, as its culinary heritage is heavily influenced by its history and geography. With influences from Romania, Ukraine, Bulgaria and Russia, Moldovan cuisine is a unique blend of flavours and traditions.

Despite its rich culinary heritage and potential, the food tourism industry in Moldova is still relatively underdeveloped compared to other countries in the region. Limited awareness and promotion of Moldovan cuisine, as well as the need for more developed infrastructure and services for food tourism, pose challenges for the industry. Through a review of the literature, the article will identify the main challenges and opportunities facing the food tourism industry in Moldova, and provide insights into the potential for growth and development. The authors will also describe their own research methods and provide an analysis of their findings, highlighting the unique contribution of their work to the existing body of knowledge in the field.

Levi-Strauss C. in 1966 (Clark, D., 2004) [1] and Douglas M. in 1972 (Dusselier, J, 2009) [5] are among the early theorists who argued that food is a crucial element in cultural identity and social behavior. They suggested that food reflects social structure, value systems, and even religious beliefs. In tourism development, food and gastronomy play a critical role in both social-cultural and economic dimensions. Gastronomy has been utilized as an important economic segment for local and regional development, with its potential for employment creation, entrepreneurship, and community development. Furthermore, gastronomy has been identified as a marketing tool for enhancing destination competitiveness (McKercher et al., 2008) [13], contributing to the image building of the destination and increasing its visibility to tourists. Alongside economic dimensions, food and gastronomy are significant markers of cultural identity, as they reflect the diversity of culinary traditions, local ingredients, and cooking techniques, which can distinguish one destination from another. Gastronomy has become an increasingly important motivation for choosing a destination, offering a growing potential to stimulate local economies (Min-Pei, L, et al., 2018) [14].

Gastronomy is a window into a country's past and present, providing insights into farming practices, ancient gastronomic traditions, customs, and manners. This paper aims to explore the potential of gastronomic tourism in Moldova and provide recommendations on how to establish and further develop it as a crucial pillar of the country's tourism industry. By leveraging the unique cultural and culinary heritage of Moldova, food tourism can contribute to economic growth and community development (Gajic, 2015) [8]. This paper will analyse the current state of the food tourism industry in Moldova and identify areas for improvement. It will also provide recommendations for promoting the country's culinary heritage, developing food-related activities and events, and improving infrastructure to attract more food tourists. Ultimately, the goal of this paper is to position Moldova as a competitive gastronomic tourism destination and contribute to the growth and success of the tourism industry in the country.

The United Nations World Tourism Organization (UNWTO) has reported that food accounts for a significant percentage of

tourist expenditure (30-40%), underlining the importance of food from an economic and marketing perspective (UNWTO, 2012),(UNWTO, 2017) [30, 31]. Academic literature on food tourism has seen considerable growth in both volume and range, with conventional approaches primarily focusing on the importance of food tourism as a key economic component and on aspects such as tourist motivation and behavior, marketing and competitiveness, innovation and creativity, as well as destination image and branding (Tikkanen, 2007; Du Rand and Heath, 2006; Sidali et al., 2015) [26, 4, 21]. Nevertheless, there is an increasing cross-disciplinary interest in food tourism as a specialized form of tourism that offers more genuine, culturally rich, and immersive experiences (Stone, M., J et al., 2020) [24]. Therefore, food tourism is a holistic experience that offers more than just sustenance and basic needs for food and drinks, and can contribute to the development and promotion of a destination.

The popularity of gastronomic tourism has grown in recent years, generating billions in revenue for businesses worldwide. This type of tourism not only motivates travel but also enriches it with authentic and memorable experiences. Such trips allow tourists to learn about regional traditions and customs, and the stories behind local products and dishes, well known wines, making gastronomic tourism a part of cultural tourism [10].

The potential of gastronomic tourism in Moldova has yet to be fully realized. While there has been some interest from foreign tourists and local travellers, the Covid-19 pandemic has greatly impacted the tourism industry as a whole. Despite this, the hospitality industry in Moldova has started to utilize gastronomic tourism as a means of attracting visitors. As the country's culinary heritage is an integral part of its culture and history, promoting and developing gastronomic tourism can contribute to economic growth and community development. However, it will require strategic planning, investment in infrastructure, and the collaboration of various stakeholders to establish Moldova as a competitive gastronomic tourism destination.

The tourism industry is expanding its accessibility to various user groups, including the elderly, families with children, individuals or small groups, people with special needs, and those travelling with animals. The global Covid-19 pandemic has had a severe impact on the tourism industry, resulting in a 74 percent decrease in tourist arrivals in 2020 compared to 2019. Although the desire to travel was limited, many residents chose to engage in local tourism or travelled to neighbouring countries. With the threat of Covid-19 subsiding, it is crucial to assess the new circumstances and consider the changing motivations and habits of tourists. As Gursoy and Chi (2021) [9] indicated, identifying what will attract customers to return is critical and requires extensive research efforts.

In today's globalized world, many countries' tourism offerings are becoming increasingly homogenized, leading to a search for more unique and diverse types of tourism. One potential avenue for development is gastronomic tourism, which has become a market segment and an essential component for differentiating tourism destinations and making them attractive (World Tourism Organization and Basque Culinary Center, 2021) [33]. The food of a particular country or region can be a significant resource for its tourism industry, as tourists are willing to devote significant time and income to quality and exciting food experiences. Additionally, sharing a meal or drink provides a context for socialization and connection with family, friends, and local communities, making gastronomic tourism an inclusive activity (Fountain, 2022) [6].

Nistoreanu, Nicodim, and Diaconescu (2018) [20] suggest that the gastronomic experience can encompass a wide range of activities, including attending cooking schools and cookware stores, collecting cookbooks, participating in gastronomic tours, consulting guides and menus, and visiting wine cellars, distilleries, and food producers. However, it is essential to recognize that these activities should not be seen merely as opportunities for tourists to spend money, but rather as chances

to immerse themselves in the culture of the country or region and enjoy a memorable holiday with friends, family, or colleagues.

The concept of gastronomic tourism is still in its early stages in Moldova's tourism and hospitality industry.

Moldova is known for its unique culinary heritage, featuring natural and locally sourced ingredients, traditional cooking techniques, and a visually appealing presentation of dishes.

Gastronomic festivals and events are among the most popular attractions for gastronomic tourists in Moldova. These events take place throughout the year, in various Moldovan cities and towns, showcasing the country's diverse cuisine and culinary traditions. Moldova's gastronomic tourism industry is growing and offers a range of experiences that are comparable to those available globally. When travelling around Moldova, visitors can enjoy both traditional and modern cuisine at restaurants, visit local farmers, participate in gastronomic festivals, tastings, and educational events (Moldova Travel, 2023) [17]. Various organizations in Moldova are making significant efforts to attract foreign tourists to the country, as well as encouraging local residents to explore different parts of Moldova.

Gastronomic tourism is a unique trend in the tourism industry that is gaining popularity each year. It offers more than just the opportunity to taste new dishes. It is incorrect to compare gastronomic tourism with classic sightseeing tourism as the former requires special organization that involves the careful selection of interesting places to visit and unique products that best showcase the state or regional authenticity. The main feature of gastronomic tours is the opportunity to taste unique dishes that are not easily found elsewhere. Cultural traditions and resources, as well as natural and climatic characteristics, shape the cultural life of a region. The level of harmony between natural and climatic conditions determines the attractiveness of the gastronomic culture in a regional context.

Gastronomic tourism has become a significant driver of the tourism industry worldwide, as travellers increasingly seek unique and authentic culinary experiences in different destinations. The Republic of Moldova, a small country located in south-eastern Europe, is not an exception to this trend. With a rich culinary heritage and a growing tourism industry, the country has the potential to become a gastronomic tourism destination.

By providing insights and recommendations for the development of this industry, this research can help guide policymakers, tourism businesses, and other stakeholders towards sustainable and responsible tourism practices, while also showcasing the rich culinary traditions and cultural heritage of Moldova to a wider audience.

In this context, the purpose of the paper is to analyze the trends and opportunities of gastronomic tourism in the Republic of Moldova and to provide strategic recommendations for the sustainable development of this industry.

## MATERIALS AND METHODS

The authors of this article used a quantitative research approach and analyzed data from the National Bureau of Statistics of the Republic of Moldova to examine the trends and opportunities of gastronomic tourism in the country.

The data analyzed included the number of tourists who visited Moldova between 2019 and 2021, specifically focusing on the types of accommodations they stayed in and their countries of origin, including the European Union, non-EU countries, neighbouring countries such as Romania and Ukraine, Muslim countries, and other countries. In addition to quantitative analysis, the authors used research methods such as analysis, comparison, grouping, and SWOT analysis in developing the paper.

## RESULTS AND DISCUSSIONS

Gastronomic tourism has become a significant driver of the tourism industry worldwide, as travellers increasingly seek unique and authentic culinary experiences in different destinations. The Republic of Moldova, a small country located in South-Eastern

Europe, nestled in the North- East of the Balkans, spans an area of 33,843.5 km2 and has a population of around 2.8 million people, according to the 2014 census (Duca Gh. et. al., 2009) [3]. This country is no exception to the trend mentioned.

We mention that in 2014, the census was conducted within the recognized borders, excluding the population of the districts on the left bank of the Dniester River and the city of Bender.

The Republic of Moldova, with its rich cultural heritage and culinary traditions, has the potential to become a major gastronomic tourism destination in the region. However, despite its potential, the industry remains underdeveloped and has not been studied comprehensively [2].

We would like to mention a specific characteristic of the country. According to the 2014 census (The Statistical Yearbook of the Republic of Moldova, 2002-2022) [23], the ethnic structure of Republic of Moldova is as follows: Moldovans - 75.1%, Ukrainians - 7.2%, Russians - 6.6%, Gagauz - 4.6%, Romanians - 2.5%, Bulgarians - 1.9%, other ethnic groups - 2.1%.

Throughout its history, Moldova has been influenced by various cultures and civilizations, including Turks, Tatars, Poles, Austrians, Russians, and Romanians. This cultural and ethnic diversity has significantly influenced the gastronomic culture, cuisine, traditions, and customs of the Republic of Moldova.

From an economic perspective, the Republic of Moldova is an agro-industrial country, specialized in viticulture, fruit growing, vegetable growing, and other agricultural crops.

Rural tourism, ecotourism, and other related activities are recognized as valuable tools for economic development, poverty reduction, and sustainable development. In this paper, we argue that food tourism can also contribute to poverty reduction and provide a sustainable approach to tourism development and management in Moldova.

The traditional Moldavian cuisine is a combination of old traditions, seasonal practices, culinary techniques, and ancestral community customs.

The rich history, culture and heritage of Republic of Moldova and particularly the various influences from foreign settlers, the hospitality of the Moldavian community as well as the authentic and unspoilt environment are key factors that underline the potential development of food tourism. Food experiences can provide a platform for further development of cultural activities and ones that tell the story of a destination, region and community. Second, a more explicit focus should be put on food tourism as an authentic, memorable and participatory experience. In this context, food should not be solely understood as a tangible product to be manufactured and sold as a tourism commodity. Instead, the focus should be on the production of food, for example, culinary traditions, authentic recipes, distinctive flavours, etc. Each region in Republic of Moldova is culturally rich and promoting food experiences that seek to unfold history, culture and heritage could greatly enhance the development of tourist activities.

In the process of examining the global map of gastronomic tourism, it is possible to conclude that there are regional administrative units that are searching for culinary products that can provide a certain uniqueness to each specific region.

In specific regions of the Republic of Moldova, the culinary traditions of diverse ethnic minorities are predominant. Consequently, there is a discernible trend toward establishing regional gastronomic hubs, even in less developed destinations, in order to draw in tourists. These efforts often lead to the creation of a territorial identity, particularly in the gastronomic realm, which is composed of specific elements (Figure 1). Ukrainians in the east consume "borsh", Bulgarians in the south serve traditional "mangea" (sauce with chicken), and the Gagauz prepare "shorpa", a highly seasoned mutton soup. Russian communities enjoy "pelmeni" - meat-filled dumplings - and a variant of Ukrainian "varenyky" called "coltunasi", which are dumplings filled with

fresh cheese, meat, or cherries, is also popular. (Moldova to visit.eu, 2023) [16].

Table 1. Tourist zones of the Republic of Moldova from the perspective of administrative development regions

| No. | Zone name | Locations and the most representative attractions in the zone [17] |
|---|---|---|
| 1. | Central Region [17], [27] | Chișinău city (ex. Bernardazzi architecture); "Artă Rustică" crafts complex; "Plaiul Fagului" nature reserve; Manuc Bey Palace; "Orheiul Vechi" cultural-natural reserve [27], Mimi Castle |
| 2. | Northern Region | Suta de Movile - Meeting with our Getae ancestors; Bălți city - Capital of the North; Barza Albă Divin - Tasting strong spirits; "Țaul" Park; Emil Racoviță Cave (Criva); Jewish Cemetery in Vadul Rașcov; Soroca Fort |
| 3. | Southern Region | Beleu Lake; Bread Museum; Old Church of the Shroud of Mother of God; Golden Hills in Văleni village; Petru Rareș Road in Văleni village |
| 4. | Gagauzia UTA Region [7] | "Gagauz Sofrası" ethno-tourism complex; P. Petkovich Ethno-Estate; At-Prolin horse farm located in Ceadîr-Lunga city; 19th-century windmill; Saint Iveron Monastery; "Zidul Troian" historical monument |
| 5. | Transnistrian Region | Tighina Fortress; Noul Neamț Monastery; Karaman House (Karaman House preserves the authentic construction style of a house from 100 years ago) |

Source: developed by the authors based on [17, 27, 7].

There are many interesting dishes of Moldovan origin in the region. It is worth starting with the "plăcintă" - pies with different fillings. Another iconic dish is corn "mămăliga" with stew. It is usually served with cheese. Popular dishes of Moldovan cuisine include "mici" (juicy beef sausages with spices and garlic), green tomato jam, "zama" (Moldovan soup served with raw egg and sour cream), chickpeas with pork, rice with sauerkraut and chicken, fried pork, (previously soaked in wine) with sauce (Moldovan broth sauce, garlic, and salt) and many other grilled meat dishes. The Moldovan government had good intentions when declaring wine as a food product in 2017 (MOLDPRES News Agency- Wine declared food product in Moldova, 2017 [18].
This seems to be a nice promotion strategy of gastronomic tourism in the Republic of Moldova.
The effect of developing gastronomic tourism on economic and social aspects is of decisive importance. It promotes recreational attractiveness at the regional level, allows the development of a modern infrastructure system in the tourism and cultural field, and serves as a basis for attracting highly qualified specialists to the region. An inherent characteristic of gastronomic tourism is a high degree of differentiation. Residents of each region, even within the same country, seek to add uniqueness to their culinary traditions. Therefore, it is possible to talk about the possibility of developing this type of tourism primarily at the regional level.
Thirdly, a new approach is needed to market and develop food-related activities as intangible heritage. While the Republic of Moldova has four traditions and customs listed in the UNESCO Representative List of the Intangible Cultural Heritage of Humanity (UNESCO, 2023) [29].
there is no inscription related to culinary tradition. However, Chișinău (the capital of the Republic of Moldova) is part of the UNESCO Network of Learning Cities (since 2020), and within this network, gastronomy/food/cuisine is considered an essential reference for creativity and innovation [28].
The variety and diversity of cooking traditions in the regions of the country represent an untapped distinctive advantage for the development of cultural and heritage tourism.
A review of specialized literature on the subject in renowned international databases, Scopus and Web of Science, reveals no research specifically mentioning "gastronomic tourism in the Republic of Moldova" from 2010 to 2023.
All elements, mentioned in Fig.1, contribute to defining the gastronomic identity and creating a complex mosaic of tastes, flavors,

and culinary experiences specific to each region or culture.

Gastronomic tourism includes unique experiences and activities related to food and drinks. This form of tourism has arisen due to globalization's growing fascination with cuisine and the diverse approaches to dining that tourists adopt while on their travels. One of the most popular gastronomic tourism activities is visiting local catering places, local markets, gastro festivals, cooking classes, food fairs and exhibitions, eating at local restaurants, eating with locals' residents, street food tasting, gastronomic tours. Tasting local gastronomy products is a trend of modern tourism, for thousands consumer-friendly way of spending leisure time and one of the main motives of many tourists.

Tourists are seeking to explore the entire process of regional food production, including growth, harvesting, transportation, and processing. They aim to taste local homemade dishes while engaging with the local residents for an authentic experience. Furthermore, they are interested in consuming dishes made from locally sourced organic ingredients.

The Republic of Moldova has the potential to become a successful destination for gastronomic tourism on a continental scale, given the volume and variety of resources available.

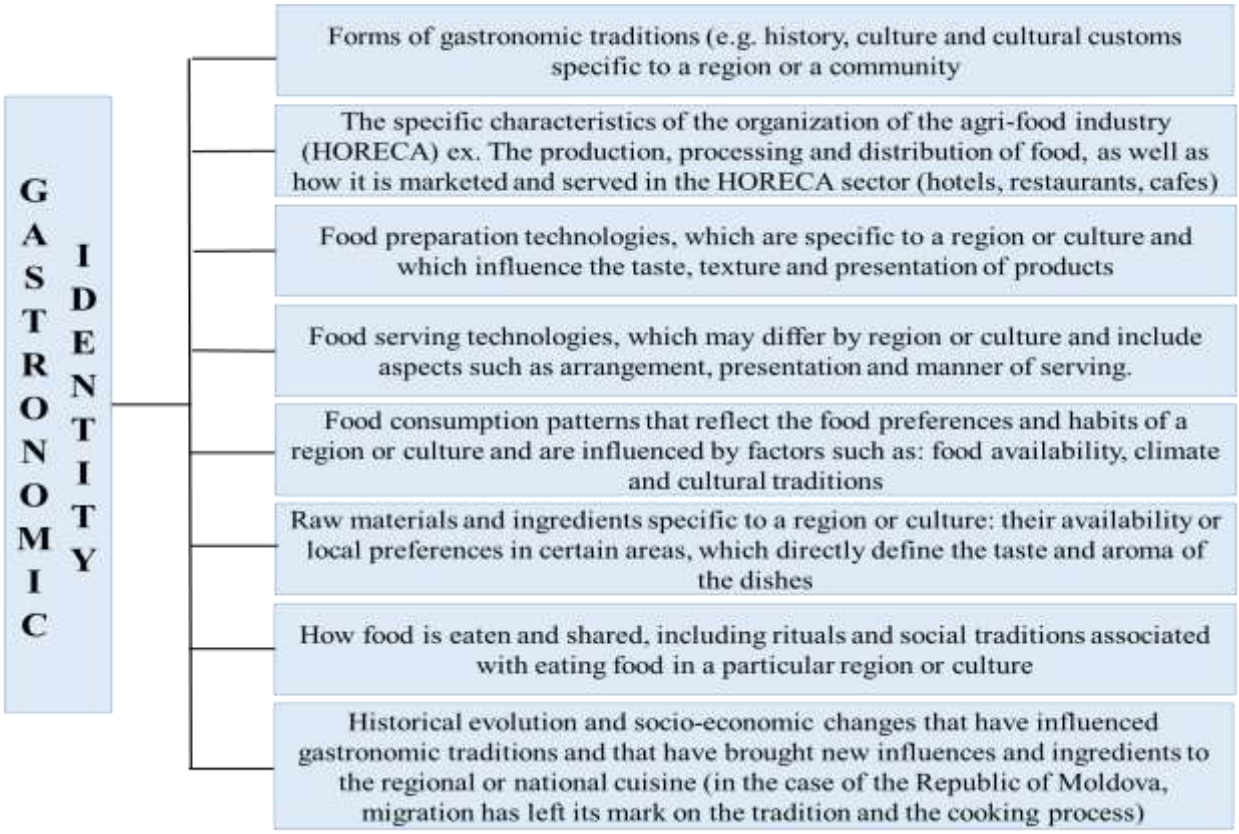


Fig. 1. Defining elements of the gastro-touristic identity of a region
Source: developed by the authors.

To achieve this, decision-making efforts should not only be focused at the national level, but also at the local level. It is worth noting that tourists make a variety of decisions before, during, and after their trips, which can greatly impact the success of gastronomic tourism in the country (Sugimoto & Nagai, 2020) [25],

Taking into account the experience of foreign countries that have achieved positive results in improving gastronomic tourism, it is necessary to emphasize the priority of state participation in the development of primary material and economic infrastructure.

An extremely important basis for improving the tourism industry is concrete measures taken at the state level.

Additionally, the state regulates the competitive parameters of existing tourism products and undertakes various actions to attract certain resources for their promotion and development. State support measures are extremely important.

The share of tourism industry in Moldova's GDP, average for 2016-2018, was 0.6%, it is expected, in line with the Strategy, to reach 0.8% (average for 2023-2025) and 1% (average for 2026-2030)(Law No 315/2022).

Table 2. SWOT Analysis of the potential for developing gastronomic tourism in the Republic of Moldova

| | |
|---|---|
| **Strengths:**<br>Rich culinary heritage and traditional dishes that are unique to the country.<br>High-quality wine industry with a long history of winemaking. Emerging trend in agri-tourism, which offers tourists the opportunity to experience rural life and traditional farming methods.<br>Increasing acknowledgment of the country's gastronomic possibilities, both on a domestic and global scale. | **Weaknesses:**<br>Limited infrastructure for food-related activities and events, which makes it challenging to promote and market its culinary heritage.<br>The lack of awareness and promotion of the country's traditional dishes and culinary customs.<br>Insufficient collaboration and coordination between stakeholders in the tourism and agriculture sectors.<br>Insufficient support from the state.<br>Poorly developed road infrastructure. |
| **Opportunities:**<br>Development of food trails that showcase the diversity of Moldova's food culture and encourage tourists to explore different regions of the country.<br>Promotion and marketing of traditional dishes and culinary heritage through social media and other marketing channels.<br>Development of food-related activities and events, such as cooking classes, wine tastings, and farm tours.<br>Growth of agri-tourism, which can provide tourists with a unique and authentic experience of rural life and traditional farming methods. | **Threats:**<br>Competition from other gastronomic destinations in the region, such as Romania and Ukraine.<br>Economic instability and political uncertainty, which can discourage investment in the tourism industry.<br>Seasonal fluctuations in tourism demand, which can make it difficult to maintain a consistent level of business throughout the year.<br>The COVID-19 pandemic and its impact on the global tourism industry.<br>The war in the neighbouring country and related risks (often restricted airspace, wave of refugees, etc.) |

Source: developed by the authors.

The National Development Strategy "Moldova Europe 2030", approved by law no. 315/2022 [11], has the following objectives:

-Development and diversification of the national tourism product, consolidation of the role of local communities and involvement of the diaspora.

-Consolidation of investments in the development of tourism infrastructure.

-Digitalization of tourism offers and products.

-Development of the workforce and educational programs.

-Formation and consolidation of tourist destinations, including through actions to promote, conserve, and restore historical monuments.

-Consolidation of the country's tourism brand and continued promotion activities in target markets.

This quote is from a report on "National Study on Moldovans' Perceptions of Local Tourism" presented by the Investment Agency in 2020, and it is reflected in the National Development Strategy "European Moldova 2030". The report mentions that "people's declared preferences are towards family, cultural, nature, and historical tourism"(Law No 315/2022) [11].

Although the tourism industry in the Republic of Moldova has been expanding, with a rise in international tourist arrivals in recent years, the contribution of gastronomic tourism to the overall tourism industry remains relatively minor. The development of gastronomic tourism in the country is hindered by several challenges, including the lack of awareness and promotion of the country's culinary heritage, the limited infrastructure and facilities for food tourism, and the low level of collaboration among stakeholders.

According to the data of the National Bureau of Statistics of the Republic of Moldova, the

flow of foreign tourists to Moldova before the pandemic in 2019 was continuously increasing, but also locals travelled within the country (Table 3).

The highest number of arrivals, in 2021, were tourists from neighbouring countries (Romania - 8,421 visitors, Ukraine - 2,735 - visitors) but also countries such as: Poland (4,147 visitors), Russian Federation (3,711 visitors), Italy (2,430 visitors) etc. However, with the influence of the global pandemic, the situation in the tourism industry has changed significantly. Already at the end of 2019, flights were stopped in many countries, which led to a decrease in the number of travellers and a deterioration in the performance of hospitality companies. The travel restrictions imposed to stop the spread of the virus have had a devastating effect on the entire tourism industry around the world, without "sparing" the Republic of Moldova.

In a very short time, this COVID-19 pandemic has left its mark on people's lifestyles: many countries have been shut down, leading to the closure of restaurants, shopping places, public events and tourism in general. One of the most effective ways to avoid the virus was to stay at home, without physical contact, which resulted in a negative influence on an individual's mental health (WHO, 2020) [12, 32].

Table 3. The number of tourists staying in touristic reception structures in the years 2019-2021, thousands of people

| Type of tourists | Arrivals | | | Percentage change of tourists arrivals, % (+/-) | | |
|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2021 | 19/20 | 19/21 | 20/21 |
| Local tourists (domestic) | 200.7 | 61.6 | 109.3 | -69.3 | -45.5 | +77.5 |
| Foreign tourists | 174.0 | 28.7 | 68.8 | -83.5 | -60.4 | +139.6 |
| Tourists from neighbouring countries (Ukraine, Romania) | 174.0 | 28.7 | 68.9 | -81.2 | 60.4 | +110.7 |
| Tourists from European Union countries | 97.2 | 15.7 | 34.8 | -83.8 | -64.2 | +121.3 |
| Tourists from Muslim countries | 8.0 | 1.8 | 3.4 | -77.8 | -58.1 | +89.0 |

Source: Authors calculations based on data from National Bureau of Statistics of the Republic of Moldova [19].
Note: Tourists from Muslim countries may have specific dietary requirements that need to be taken into account when developing food-related activities in Moldova. This includes the need for halal food options, which are foods that are prepared in accordance with Islamic dietary laws.

Based on Table 3, we found that in 2021, compared to 2020, the number of domestic trips (by Moldovan citizens) increased significantly marking an increase of about 77.5% compared to 2020 (Table 3). Meanwhile, the number of tourists from neighbouring countries - such as: Romania (EU country) and Ukraine (non-EU country) increased by about 110.7%, tourists from EU countries had an increase of 121.3%, tourists from Muslim countries (from: Turkey, Kazakhstan, Uzbekistan, Kyrgyzstan) had an increase of 89%. A significant increase of 173.3% was tourism from other countries, tourists from the Russian Federation dominate with the highest share, followed by Israel, USA, Canada, Belarus, Switzerland, etc. In 2021 compared to 2019 visitors from China, Georgia, Norway and Japan - were less attracted to the Republic of Moldova.

Neighboring countries, particularly Ukraine and Romania, constitute a significant proportion of tourists visiting the Republic of Moldova. These tourists are drawn by the shared history and culture of the region, as well as the traditional Moldovan gastronomy and wines. Additionally, accessibility and geographic proximity make cross-border tourism convenient, creating opportunities for the Republic of Moldova and neighboring countries to develop joint tourism packages.

In 2021, establishments offering collective tourist accommodations experienced an increase in visitors, with 178.2 thousand tourists, which is twice as many as the previous year. This surge in visitors follows a decline of about 284.4 thousand tourists (4.1 times) in 2020 compared to 2019. Out of the total number of tourists, 109.3 thousand (61.4%) were residents, and 68.9 thousand (38.6%) were non-residents. The majority of

overnight tourists preferred to stay in tourist accommodation establishments in mun. Chisinau, accounting for 59.1% of the total, followed by the development regions of Centre - 23.9%, South - 8.2%, North - 7.3%, and UTA Gagauzia - 1.5% [15].

In 2021 travel agencies and tour operators provided tourist services to 320.9 thousand tourists and excursionists or 2.6 times more than in 2020.

The increase in the number of tourists and excursionists is due to the increase in the number of outbound tourists by 143.0 thousand persons (2.9 times), domestic tourism - by 36.3 thousand persons (by 1.8 times) and inbound tourism - by 17.1 thousand persons (3.5 times) (Moldova in figures, Statistics in brief, 2022) [15].

Table 4 shows the number of tourists accommodated in collective tourist accommodation facilities with accommodation functions in the years 2010-2021. The data suggests an overall increase in the number of tourists accommodated in hotels and motels, from 93,911 in 2010 to 213,808 in 2019.

Table 4. Number of tourists accommodated in collective tourist accommodation facilities with accommodation functions in the years 2010-2021, people

| | 2010 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Hotels and motels | 93,911 | 203,188 | 213,808 | 50,581 | 99,970 |
| Pensions and agro-touristic pensions | 13,290 | 17,709 | 17,168 | 14,576 | 21,411 |
| Touristic villages and other types of rest accommodation (touristic villas, bungalows, camping) | 18,386 | 54,310 | 55,853 | 11,519 | 29,831 |
| Holiday camps for children | 63,350 | 50,969 | 50,833 | 219 | 2,775 |
| Others types (Health-care structures & Hotels for visitors) | 40,956 | 38,432 | 37,103 | 13,443 | 24,209 |
| Total | 229,893 | 364,608 | 374,765 | 90,338 | 178,196 |

Source: Authors calculations based on data from National Bureau of Statistics of the Republic of Moldova [19].

However, as a result of the COVID-19 pandemic, the number of accommodated tourists in 2020 plummeted to 50,581, but began rebounding in 2021, reaching 99,970. The figures for tourists staying in pensions and agro-touristic pensions remained fairly stable over time, with a minor increase from 17,168 in 2019 to 21,411 in 2021. The number of tourists accommodated in touristic villages and other of rest accommodation rose from 54,310 in 2018 to 55,853 in 2019, but then dropped to 11,519 in 2020 due to the pandemic. This number also started to bounce back in 2021, attaining 29,831. The number of tourists accommodated in holiday camps for children has been on a downward trend since 2010, falling from 63,350 to 219 in 2020, but it climbed to 2,775 in 2021. Lastly, the number of tourists accommodated in other types of facilities, such as health-care structures and hotels for visitors, declined from 37,103 in 2019 to 24,209 in 2021. Overall, the COVID-19 pandemic significantly impacted the number of accommodated tourists in 2020, but recovery signs emerged in 2021.

Experts report that Moldova's tourism industry experienced unprecedented growth in 2022 and fully rebounded from the downturn caused by the COVID-19 pandemic. According to statistics, in 2022, domestic (internal) tourism increased by 56% compared to 2021. Encouragement of domestic tourism is backed and promoted by the Government of the Republic of Moldova through a variety of initiatives and campaings, collaborating with tourism bloggers, journalists, photographers, and tourism experts (such as TURisto ACTIVisto, www.calatoriicugust.com, ETNOtravel, and Radio Moldova - Popas Turistic) who participate in the fourth edition of the "Ne-am Pornit" campaign, in 2023.

Despite these challenges, there are significant opportunities for the development of gastronomic tourism in the Republic of Moldova. The country's rural areas, with their traditional farming methods and small family farms, offer great potential for agri-tourism,

allowing visitors to experience the country's rural life and learn about traditional farming practices. Many of these farms also offer accommodations and activities such as cooking classes, farm tours, and wine tastings. The development of food-related events and festivals, such as the National Food Day of specific type of dishes and region, could also help to promote the country's gastronomic culture and attract more food tourists.

A combination of factors, including culinary heritage, availability of local food products, quality of dining experiences, accessibility and transportation, marketing and promotion, government support, and local community involvement, can influence the success of food tourism in the Republic of Moldova.

There are several strategies that can be employed to establish and further develop the food tourism industry in Moldova:

-Promote Moldovan cuisine
-Increase food-related activities and events
-Improve infrastructure and services
-Foster collaborations
-Leverage digital platforms

By implementing these strategies, Moldova can establish and further develop its food tourism industry as an important pillar of the country's tourism industry, contributing to economic growth, job creation, and the promotion of its unique culinary heritage.

## CONCLUSIONS

The present Moldova cuisine is a combination of different tastes, flavours, and influences of diverse cultures and civilisations. Also, the in-country, differences between the regions are notable as inherited from earlier generations.

Nowadays, it is hard to imagine living without traveling; it is becoming one of the humans' desires that needs to be met. However, due to globalization, different countries are becoming more similar to each other and starting to lose their uniqueness, so tourists are getting bored and look for something special and not usual to them. Because of the changing travellers' needs, gastronomy or activities, which are related to it, more often become the destination of the trip. At this time, gastronomic tourism is considered to be the branch of tourism, which is growing the fastest in the world. Gastronomic tourism is becoming an important part of the tourism industry because food has become an essential inducement for differentiating tourism destinations and making them attractive. It becomes attractive, because it includes not only food tasting, but also various gastro events, tours and experiences designed to improve cooking and consumption skills. Gastronomic tourism together provides an opportunity for a city or some local place to increase its visibility in strengthening region's identity, sustaining its cultural heritage. Gastronomic tourism in Moldova is still a relatively new phenomenon, but it is also becoming more popular. Moldovan cuisine is famous for its natural products and original way of preparing food, old but newly applied cooking traditions, and the aesthetics of serving dishes.

There is a lack of the information for the local tourists about the gastronomic tourism events, gastro festivals.

Cooking and eating together with the local population is offered to spread the awareness of the dishes of the ethno-regions. The results obtained during the comparative market analysis revealed that currently the potential of gastronomic tourism in Moldova is mostly not discovered.

In conclusion, the findings of this research demonstrate that gastronomic tourism has significant potential for development in the Republic of Moldova. The country's rich culinary heritage, wine industry, and rural areas offer unique and authentic experiences for food tourists. However, there are several challenges that need to be addressed to fully develop the gastronomic tourism industry in the country.

One of the main challenges is the lack of awareness and promotion of the country's culinary heritage. Efforts to promote and market the country's traditional dishes, wines, and food-related activities could help to attract more food tourists.

Despite its undeniable popularity and merits, the modern classification of ethno-gastronomy is rarely seen as an independent category, and its place in the tourism industry is ambiguous.

At the same time, in recent years, gastronomic tours have become in demand as an independent component, with around 40% of tourists expressing an interest in them. Getting to know the national traditions of different cuisines around the world is becoming a fundamental reason for them to travel.

It is necessary to carry out coordinated organisational and economic planning is a set of measures, means and techniques aimed at the creation, development and subsequent maintenance of a new tourism sphere in each individual region.

The successful development of ethno-gastronomic tourism is impossible to imagine without a clear structuring of the sphere. This will allow the area not only to develop successfully, but also to gain a worthy competitiveness, both on the domestic and on the regional and even global tourist market. Management and development programmes should also be created at both national and regional level.

Overall, this study of gastronomic tourism in the Republic of Moldova is a relevant and significant subject that merits consideration from both scholars and decision-makers. With this investigation, we aspire to aid the growth of this industry and to promote Moldova as a unique gastronomic tourism destination in the region.

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# STATE AND DYNAMICS OF LAND RELATIONS IN BULGARIA - A REVIEW

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***Abstract***

*The institutional environment in Bulgarian agricultural sector is a complex system of relationships, dynamically changing under the influence of national and sectoral legislation. Over the last 16 years, was characterized as a difficult period for agriculture and land relations in Bulgaria – because of insufficient legislation the Ownership and Use of Agricultural Land Act about 34 changes have been made to the Act, which are directed in the interest of agricultural users. The changes made concern the concluded contracts for the use and lease of the agricultural land. The dynamics and future changes in land relations are inextricably linked to changes in European and national policy. Receiving European subsidies and financial support to the income of Bulgarian farmers deforms the economic environment in our country. The European subsidies are a key motive and priority for farmers. The purpose of this paper is to describe the state in Bulgarian agricultural sector which is characterized by intensity and dynamics, more complexity and instability. The value of the gross agricultural output had declined during the last years. This research work is based on the following methodological approaches: complex, structural and comparative. The theoretical framework of this article provides a summary overview of the main institutional changes in the agricultural policy and the structure of land relations in Bulgaria. For the purposes of the research different information sources have been used - scientific journals, as well as the author`s own research.*

***Key words*****:** *land relations, state, agriculture*

## INTRODUCTION

The issues related to the analysis of land relations are of continuing relevance and importance. The relevance of the issue results from the structural changes that have taken place in Bulgaria after our country’s accession to the Common European Economic Area. The importance of an analysis of this issue is also derived from the need to handle certain problems that have emerged as early as during the land reform, as well as issues that have arisen as a result of the implementation of the Community Agricultural Policy. Obtaining financial means to support income and incentives to comply with other European policies distorts the business environment in Bulgaria [1].

Payment per unit of area triggers processes of a number of imbalances in the sector. Fewer and fewer farms cultivate more and more land. Accordingly, they receive an increasing part of the financial flows intended to support income, which is in dissonance with the philosophy of the Community agricultural policy and the main idea of the founding documents of the EU [2].

In today's increasingly digitized world, economic and social processes in agriculture are in a dynamic relation with the state of land relations.

In this context, the purpose of this article is to analyze the dynamics in the state and development of land relations in Bulgaria which is characterized by great intensity related to the context of the Common agricultural policy [4].

## MATERIALS AND METHODS

A number of contemporary scientific quantitative and qualitative methods are used to achieve the intended objectives set in this research: system and comparative analysis.

The purpose of this paper is to describe the state in Bulgarian agricultural sector which is characterized by intensity and dynamics, more complexity and instability. The value of the

gross agricultural output had declined during the last years.

For the research analysis we shall apply the scientific approach as well as the following methodological approaches, such as: complex, structural and value-measuring. In order to achieve the intended purpose a number of contemporary scientific quantitative and qualitative methods will be used in this analysis, such as: systematic and comparative. The diversity of approaches makes it possible to identify the factors that determine the processes in land relations in Bulgaria [11].

## RESULTS AND DISCUSSIONS

The dynamics and future changes in land relations are inextricably linked to changes in European and national policy [12]. Receiving European subsidies as financial support for the income of Bulgarian farmers deforms the economic environment in our country. The European subsidies are a key motive and priority for farmers [12]. The institutional environment in Bulgarian agricultural sector is a complex system of relationships, dynamically changing under the influence of national and sectoral legislation. [3]. The institutional framework is a key factor. The elements of the institutional framework are:

• Legal framework;

•Transferability of properties, transaction costs;

• Land taxation systems;

• The financial markets; especially, access to credit.

• Land Registry.

The relevance of the issue related to land relations is accompanied by a number of challenges, measuring the transaction costs resulting from the fragmentation and consolidation of agricultural land rights.

As one of the new EU Member States, by the end of 2020 Bulgaria will apply a simplified system for allocating direct payments to farmers - known as the Single Area Payment Scheme [9].

Under this scheme, the amount of the basic income support for Bulgarian farmers is linked to the area of land declared by the farmer.

The results of the institutional changes are that Bulgaria is still in a period of dynamic changes that are actively affecting the state of land relations. The Ownership and Use of Agricultural Land Act, logically, has undergone the most changes (more than 76 changes by 2022). This dynamic of the Ownership and Use of Agricultural Land Act reveals the existence of real issues in the socio-economic system of agriculture and the need to solve them [8].

Table 1. Cultivable land, used agricultural area in Bulgaria in the period 2018-2021, ha

| **Land with crops** | **2018** | **2019** | **2020** | **2021** | **2021/2018 %** |
|---|---|---|---|---|---|
| Wheat | 1,237,736 | 1,250.478 | 1,203,964 | 1,247,453 | 100.78 |
| Barley | 115,773 | 112,264 | 131,340 | 139,109 | 120.15 |
| Rye | 29,767 | 28,163 | 25,875 | 35,053 | 117.75 |
| Oats | 16,886 | 13,866 | 11,386 | 10,421 | 61.71 |
| Corn | 478,357 | 641,555 | 642,373 | 633,735 | 132.48 |
| Sunflower | 859,910 | 789,604 | 888,200 | 840,185 | 97.70 |
| Tobacco | 8,668 | 4,849 | 5,440 | 3,015 | 34.78 |
| Industrial oil crops | 203,397 | 158,305 | 120,055 | 142,838 | 70.22 |
| Potatoes | 14,611 | 11,177 | 11,524 | 12,363 | 84.61 |

Source: Annual report on the condition and development of agriculture, 2022, Use of the areas for agricultural purposes, pp.15, Ministry of Agriculture, agraren doklad 2022.pdf [6].

The area with agricultural purpose in 2021 is 5,227,350 ha, which represents about 47% of the country's territory.

The utilized agricultural area is formed by the arable land, the permanent plantations, nurseries, permanent grass areas and family gardens. In 2021, its size was 5,046,597 ha - without significant change compared to the previous year, representing 45.5% of the country's territory.

Cultivated land includes the areas where crop rotation is applied, the temporary ones meadows with wheat and leguminous grasses, fallows and greenhouses. In 2021, the arable land grows by 0.3% on an annual basis, up to 3,486,748 ha or 69.1% of the used agricultural area.

Table 1 presents the situation of utilized agricultural area by crop in Bulgaria in the period 2018-2021.

The figures show that in 2021, wheat remained cultivated on a relatively similar surface, while maize, barley and rye were cultivated on a larger area by +31.28%, +20.15% and, Respectively by + 17.75%.

At the same time, in the same interval, the cultivated land with oats, sunflower, potatoes and tobacco decreased by: - 38.29%, -2.30%, -15.39%, and, respectively, by - 65.22%.

As a result the structure of the utilized agricultural area by crop in 2021 compared to 2018 is completely different.

Over the last 16 years after the accession of the country to the European Union, the Ownership and Use of Agricultural Land Act about 34 changes have been made to the Act, which are directed in the interest of agricultural users. The changes made concern the concluded contracts for the use and lease of the agricultural land. One-year leases contracts are signed by only one of the co-owners with more than 25 percent of the land, limiting the other co-owners from participating in the deal. Mass lease contracts have a long term - more than 10 years, and the main problem is their unification, which makes it difficult to change the clauses of the contract.

Everything listed so far is in the interest of the land user to benefit from direct payments and European programs. This clearly shows that the Ownership and Use of Agricultural Land Act and other regulations have been changing in recent years in the interest and benefit of agricultural producers. Very often the owners are harmed, which led to the creation of the Bulgarian Association of Agricultural Land Owners, which takes care of their legal interests, as well as the proper use of agricultural land.

## CONCLUSIONS

After the transition from one political ideology to another, more than 10 years were necessary for the Bulgarian government to complete the land reform. The value of the gross agricultural output had declined during the last years.

The present article and the analysis carried out would provide a good opportunity to use the new models, which would allow the construction of an effective agricultural farm management strategy, as well as the construction of a strong bond between science, practice and business in Bulgaria [6].

The results presented will provide an opportunity to redirect part of the scientific potential in the field of agricultural sciences in Bulgaria to topical and significant issues not only in the agricultural sector, but also in the national economy [10].

This will contribute to a general improvement of the situation in the industry, as well as to a more efficient disbursement of financial assistance for the period 2020+, taking into account the national priorities and achievement of results [7].

For the period 2021-2027, in the provision of European funds to support Bulgarian farmers, it is brought out in compliance with national priorities and the achievement of results by the EU member states [12].

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# CLIMATE CHANGES AND THE NEED TO SUBSIDIZE THE ACTIVITY OF SMALL-SCALE VEGETABLE FARMS IN ROMANIA

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***Abstract***

*The paper emphasizes the importance of subsidizing agricultural activities, taking into account the climate changes that are more and more evident making agricultural holdings particularly vulnerable from an economic point of view, the most exposed being the small ones. The technical-economic the economic-financial analysis methods drew a technical-economic diagnosis of a small-scale vegetable farm in Romania, in order to highlight the major impact that subsidies have in achieving incomes that ensure the continuity of the activity. The vegetable farm under study was established in 2018, being included in the category of micro-enterprises paying income tax. It owns agricultural land exclusively on lease, the existing crops being those of wheat, corn, alfalfa, bell peppers and melons, with average productions/ha achieved similar to or below the average productions/ha recorded at national, regional and county level. From an economic and financial point of view, this holding presents a financial instability during the analysis period, based on the losses recorded in 2018 and 2020 and a non-compliant financial autonomy based on insufficient equity capital. It does not have the ability to generate constant profit during the period included in the study by capitalizing on production, it being small and insufficient, which denotes the major dependence on the income from exploitation subsidies in order to be profitable. Liquidity indicators evolve fluctuating and solvency is generally downward and positioned above the safety threshold, which places small-scale vegetable farms at risk of insolvency.*

***Key words*****:** *small-scale vegetable farm, gross product, subsidies, revenues, expenses, performance, profitability, financial balance, solvency, liquidation of the activity*

## INTRODUCTION

As a form of financial support, subsidizing in agriculture aims to promote economic and social policy in Romania [1]. Subsidies are sums collected from the state budget, on a non-refundable basis, to support the current activity of agricultural holdings and are considered, from an accounting point of view, income in advance. Entities in agriculture can benefit from certain forms of financial support, regulated by various normative acts [3]. From the point of view of the legal basis, we highlight in this paper the direct payment schemes and the transitional national aids, which are applicable in agriculture. We mention in the structure of direct payment schemes, the single payment scheme per area, the redistributive payment, the payment for agricultural practices beneficial for the climate and the environment, the payment for young farmers, the coupled support scheme, the simplified scheme for small farmers, but also the eco-schemes, among which we recall the ecoschema applicable in arable land [4].We define the farmer as a natural or legal person or an associative form of natural or legal persons, regardless of its legal status, whose holding is located on the territory of Romania and which carries out an agricultural activity [12, 11]. By referring to the agricultural activity, we mean the production, growing or cultivation of agricultural products, including harvesting, milking, reproduction of animals and their holding for agricultural purposes, but also the maintenance of an agricultural area in a condition that makes it suitable for grazing or cultivation, without no preparatory action that goes beyond the usual agricultural methods and equipment.

In order to benefit from subsidies, farmers must be considered active farmers and must meet certain conditions. Verifiable evidence regarding the fulfillment of some of the conditions provided for in the legislative regulations regarding the granting of subsidies, must be included in the annual financial statements, respectively the annual accounting reports, accompanied by the "Informative data" form, drawn up according to the provisions of the accounting law [15]. Also, the farmer has the obligation to record in his own accounting, according to the legal provisions, the data from the internal accounting documents that he submits to APIA [8].

Through the diagnostic analysis carried out in the paper, we aimed to describe the functioning and evolution trends of the activity of a small-scale vegetable farm, taking into account the dynamic environment in which it operates as well as the major influence of climate change. In the category of climate changes, with a direct effect on the agricultural activity in vegetable farms, we mention the lack of precipitation that leads to a pedological drought and that led to the compromise of crops in previous years. Thus, the structure ratios of the asset and the liability were analyzed, which measure the relative importance of the elements of the nature of assets, capitals and liabilities in the total of the two structures of the balance sheet, appreciating the investment, exploitation and financing activity of this agricultural company but also the policy adopted by it in the financial sphere, by highlighting some aspects regarding financial stability, financial autonomy, as well as the degree of indebtedness [14].

The analysis of the financial performance of the small-scale vegetable farm in the period 2018-2021 and the evaluation of its capacity to generate profit was also made, highlighting the income structure, generated by resource-producing transactions and the structure of expenses, related to resource-consuming transactions. The profitability analysis highlighted the degree in which the capital, in its entirety, generates profit and maintains a financial balance, that is, the small-scale vegetable farm has the ability to carry out from the cash receipts the uninterrupted repayment of previously contracted debts, including the term ones briefly related to exploitation or fiscal legislation, in order to avoid the risk of bankruptcy and survival on the market [5].

## MATERIALS AND METHODS

The small vegetable farm, established in 2018, whose main activity is the cultivation of cereals and oleaginous plants on a land area of 56 ha in 2022, is located in Romania, Ialomița county, Tăndărei, in an agricultural area that offers a high pedological potential (soil type: chernozioms, cambic, reddish-brown, alluvial, saline-solonceacs and solonets) and a climate suitable for agriculture (temperate-continental climate, with relatively annual and diurnal thermal amplitude) high - average annual felt temperature, 10.4 °C - very hot, periodically dry summers - low annual amount of precipitation, about 450 mm annually - cold winters, frequently marked by strong blizzards) [10].

From an accounting point of view, this company is included in the category of micro-entities, being a limited liability company paying income tax, with a sole partner and no employees. In the paper, a series of technical-economic and economic-financial indicators were calculated and interpreted, based on the annual financial statements of this farm.

## RESULTS AND DISCUSSIONS

In 2022, the small-scale plant farm has in operation a total area of 56 ha of agricultural land, exclusively leased, with lease contracts concluded for a period of 10 years. For the owned land areas, they benefit from different forms of subsidies, some as in the form of the package for green crops but also the package intended to protect the red-necked goose. In 2019, these subsidies had a total value of 95,621.8 lei, registering a decrease by 15.94% (80,377.7 lei) in 2020 compared to 2019 and an increase of 145.05% (196,968 lei) in the year 2021 compared to the year 2020. In order to preserve the soil structure and obtain large

productions with optimal quality, the small-scale vegetable farm has a rotation that takes into account a rotation that preserves the organic matter in the soil, being considered the optimal solution for this.

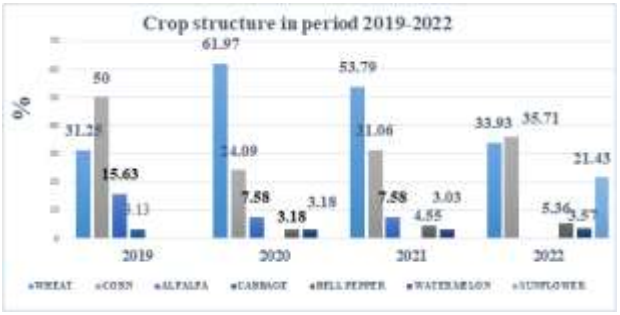


Fig. 1. Crop structure 2019-2022 (%)
Source: The farm records of the small scale vegetable farm.

Within this holding we find that, the crops included for achieving an environment-friendly rotation are: wheat, corn, alfalfa in the years 2019, 2020 and 2021, to which are added the bell pepper and watermelon crops in the years 2020, 2021 and 2022 as well as the sunflower crop from the year 2022. Regarding the wheat crop, we notice an oscillation of the cultivated areas during the analysis period, as follows: in 2019 wheat is found on an area of 10 ha and increases significantly in 2020 by 30.72%, followed by a decrease in cultivated areas in 2021 and 2022, by 8.18% and 28.04%, respectively. Regarding the corn crop, we note an oscillation of cultivated areas as follows: in 2020 compared to 2019, a decrease of 3.13% was observed, followed by an increase of 32.26% in 2021 compared to 2020, but in the year 2022 the area cultivated with corn decreased by 2.44%.

The alfalfa crop, being a perennial plant, remains on a constant surface in the years 2019-2021, respectively on a surface of 5 ha. Regarding the bell pepper culture, we notice an increase in cultivated areas, as follows: in 2021 compared to 2020, the area increases by 50%, remaining unchanged in 2022. Cabbage was cultivated only in 2019 on an area of 1 Ha, representing 3.13% of the total area. The watermelon culture remains constant on an area of 2 ha, in the years 2019, 2020 and 2021. The small-scale vegetable farm introduced crop irrigation on an area of 32 ha from the year 2022, of which: 20 ha for the corn crop and 12 ha for the sunflower crop.


Fig. 2. Income from subsidies (Lei).
Source: [9].

Considering the favorability of natural conditions, climatic, edaphic and technological factors, the inputs used and how they are applied (seed, fertilizers and plant protection products) as well as the introduction of crop irrigation from 2022, the average productions per hectare achieved of small-scale vegetable farming are also favorable (Figs. 3, 4, 5, 6).

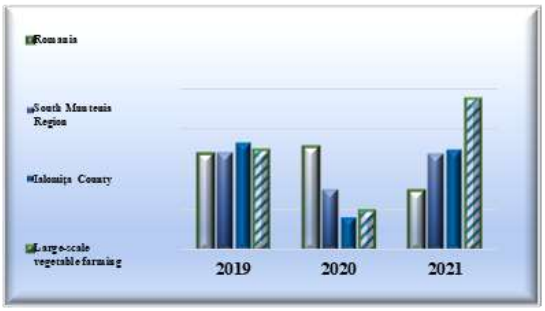


Fig. 3. Average production/ha in the wheat crop comparative situation by year and at Ialomita county, South Muntenia region and country level (kg/ha)
Source: The farm records of the small scale vegetable farm.

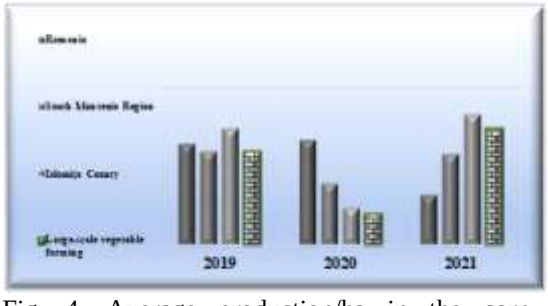


Fig. 4. Average production/ha in the corn crop comparative situation by year and at Ialomita county, South Muntenia region and country level (kg/ha)
Source: The farm records of the small scale vegetable farm.

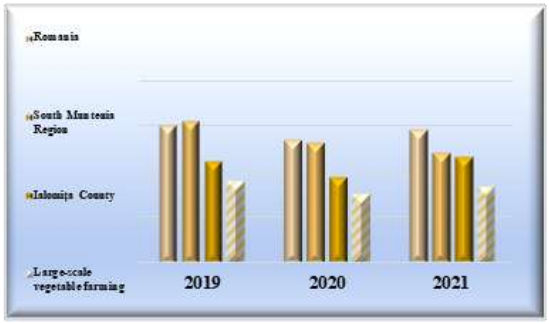


Fig. 5. Average production/ha alphaalpha comparative situation by year and at Ialomita county, South region and country level (kg/ha)
Source: The farm records of the small scale vegetable farm.

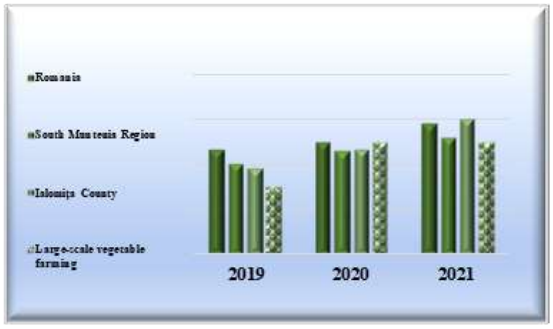


Fig. 6. Average production/ha watermelon comparative situation by year and at Ialomita county, South Muntenia region and country level (kg/ha)
Source: The farm records of the small scale vegetable farm.

Regarding the **wheat crop**, the average production per ha achieved by the small-scale vegetable farm was as follows: in 2019 it recorded increases of 5.29% compared to the productions recorded at national level and 2.94% compared to of the average productions recorded at the regional level, but compared to the average wheat production recorded at the level of Ialomita county, this being 5.89% lower. The year 2020 was a poor agricultural year for the wheat crop with an average production/ha that did not exceed the national level (lower by 60.91%) nor the regional level (lower by 32.57%). But the small agricultural holding exceeded the average wheat production recorded in Ialomița county, by 23%, but the production was small (2,000 kg/ha), an aspect that determined the small vegetable agricultural holding to reduce the areas cultivated with wheat in the years next and to reorient towards more drought-resistant crops, as well as the introduction of crop irrigation from the year 2022, to maize and sunflower crops [7]. The year 2021 was a beneficial year for the wheat crop, a year in which the small-scale vegetable farm exceeded the average production/ha of this crop by 57.55% compared to the national level, by 56.35% compared to the level recorded in South-Muntenia region and by 50.51% compared to the county level.

Regarding **the corn crop**, we note the following situation: in 2019, the average production achieved by the small-scale vegetable farm was lower than that recorded at the national level, by 7.28%, but at the same level as the average production/ ha registered at the regional level, and 19.38% lower than the one registered at the level of Ialomita County. The 2020 agricultural year was a poor agricultural year for the corn crop, the agricultural holding being below the average production per hectare in Romania (by 71.14% lower), in the South-Muntenia Region (by 49.71% lower), and county (15.86%), the agricultural society taking the decision to introduce irrigation to this crop, an objective achieved for the agricultural year 2021-2022. But the average corn production/ha achieved in the following year, which exceeded the national average by 131.48% and the regional one with 29.27%, but it was below the average production per hectare at the county level by 10.65%.

**In the alfalfa crop**, we notice an oscillation of the average production per hectare achieved, which was every year below the average production recorded at national level (in 2019 by 40.27% lower, in 2020 by 44.44% more low and in 2021 by 42.85% lower), at the regional level (in 2019 by 42.03% lower, in 2020 by 43.09% lower and in 2021 by 30.89% lower) as well as compared to the level of Ialomita County (in 2019 19.72% lower, in 2020 21.42% lower and in 2021 27.47% lower).

In the **watermelon crop**, in 2019 we note a decrease in the average production/ha achieved by small-scale vegetable farms compared to the national average (-35.80%), the regional average (-25.37%) and the Ialomița County average (-22.30%). In 2020, the average production/ha followed the same

trend as the average productions recorded below the national level (-0.25%), above the regional level (+8.40%) and the county level (+6.86%). In the year 2021, there is a decrease in the average production of melons, compared to the national average (-14.45%), the regional average (-3.53%) and the Ialomița county average (-16.88%).

Regarding the capitalization prices of agricultural products, the upward evolution from one year to the next can be noted.

**The most spectacular growth was highlighted in wheat** (an increase of 101.22% in 2022 compared to the previous year) and corn (an increase of 58.33% in 2022 compared to the previous year). Analyzing the gross product made by the small vegetable farm for each hectare cultivated with wheat, it is found that, in 2020, the most unfavorable economic situation for this crop is recorded, with a gross product located at a level of 56.54% compared to than the one recorded in 2019 and at 64.87% compared to the gross product of 2021. Production expenses per hectare registered an oscillating trend during the analysis period, with a decrease of 22.67% in 2020 compared to 2019 and an increase of 35.08% in the year 2021 compared to the year 2020. The total expenditure on the wheat crop evolved upward, taking into account that the area cultivated with wheat fluctuated during the analysis period, by 213.19% in the year 2020 compared to year 2019 and by 18.4%in 2021 compared to 2020 (Fig. 7).

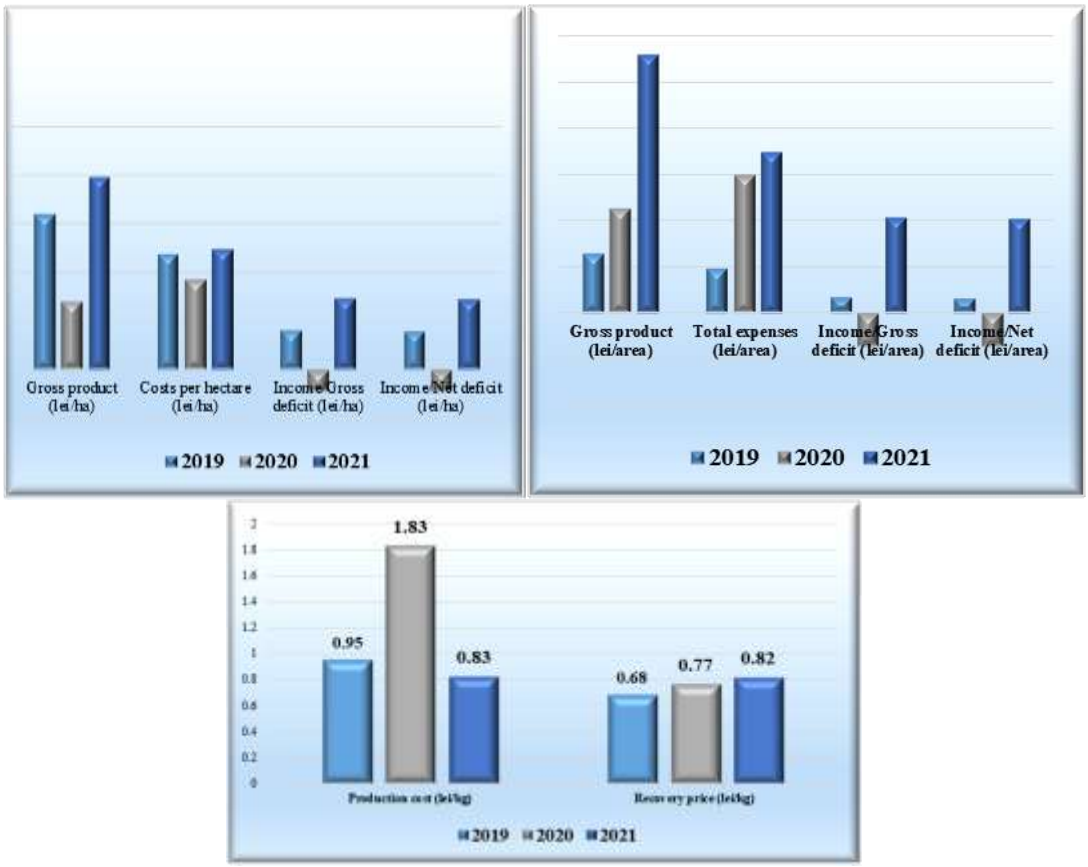


Fig. 7. Economic indicators per ha, per total area and production cost and recovery cost evolution for wheat 2019-2021

Source: Results obtained from data processing from Interview Guide addressed to small scale vegetable farming.

Considering the small productions in 2020, the small-scale vegetable farm recorded a wheat crop deficit, which could not be compensated even by the subsidies received. The best year for the wheat crop in terms of income was 2021, with a net income that exceeded by 543.7% the net income in 2019. The cost of production, influenced both by the total expenses incurred to the wheat crop as well as the productions achieved, it increased in 2020 compared to 2019 and 2021, against the background of quantitatively small

productions, respectively 1.83 lei compared to 0.95 lei in 2019 and 0.83 lei in 2021, prolific agricultural years, in which the small-scale vegetable farm obtained quantitatively significant productions, which led to a decrease in the production cost of wheat. As for the wheat capitalization price, it is mainly influenced by the market, the quality of the product and the negotiation with customers that the small-scale vegetable farm has achieved. It is noted that, except for the year 2021 when the wheat capitalization price was approximately equal to the production cost, in 2019 and 2020 the agricultural company capitalized wheat production at prices lower than the expenses incurred, respectively by 0.27 lei in year 2019 and by 1.06 lei in 2020. It is necessary to underline the fact that in the respective years, 2019 and 2020, this deficit of expenses for the wheat crop was partially covered by the operating subsidies received by the vegetable farm analyzed, but the economic results were not positive.

**Regarding the gross product made on each hectare cultivated with corn**, it is found that in 2020, the most unfavorable economic situation is recorded with a gross product located at a level of 59.80% compared to that recorded in 2019 and at 70 .96% compared to the gross product of 2022. Production expenses per hectare registered an oscillating trend during the analysis period, with a decrease of 21.72% in 2020 compared to 2019 and an increase of 67.81% in year 2021 compared to year 2020.

The total expenses for the corn crop had an oscillating evolution during the analyzed period, noting a decrease of 24.16% in 2020 compared to 2019 and an increase of 121.95% in 2021 compared to 2020 (Fig. 8).

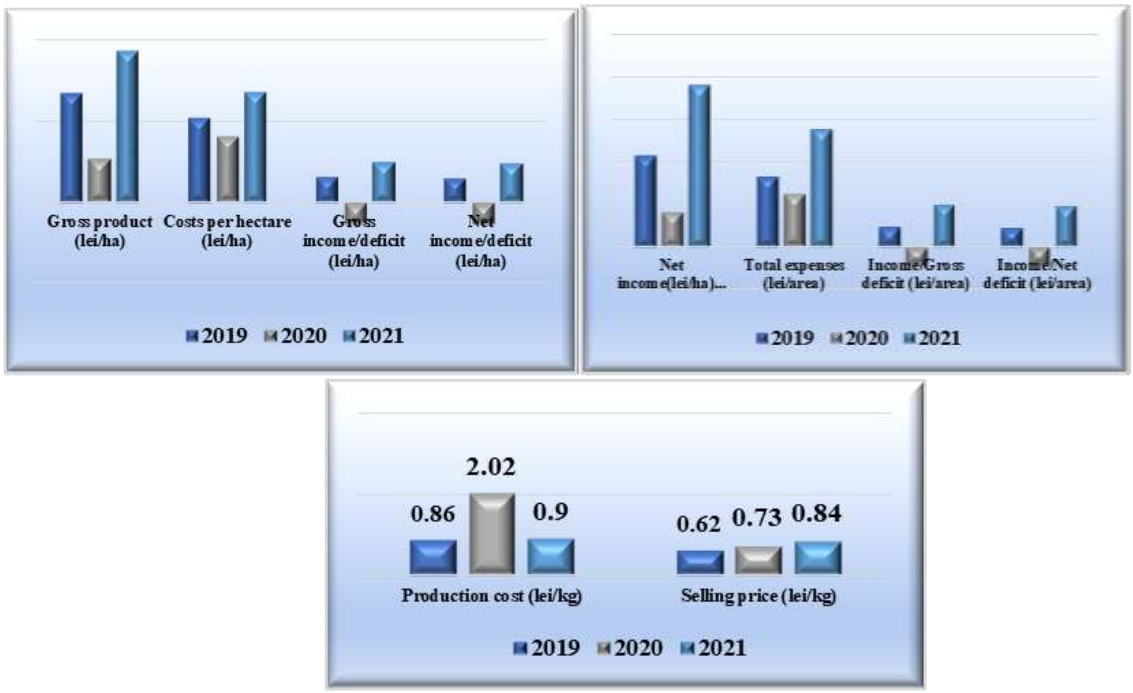


Fig. 8. Economic indicators per ha, per total area and production cost and recovery cost evolution for corn 2019-2021

Source: Results obtained from data processing from Interview Guide addressed to small scale vegetable farming

Considering the small productions in 2020, the small-scale vegetable farm recorded a deficit in the corn crop, a deficit that could not be compensated by the subsidies received. The best year for the corn crop in terms of income was 2021, with a net income that exceeded by 25% the net income in 2019.

Regarding the cost of production, there is an increase in the year 2020 compared to the years 2019 and 2021 for corn, against the background of quantitatively small productions, respectively 2.02 lei compared to 0.86 lei in 2019 and 0.9 lei in 2021, favorable agricultural years in which the agricultural

holding of small dimensions obtained quantitatively significant productions. With regard to the corn capitalization price, it is noted that, in 2019, 2020 and 2021, the agricultural company capitalized the corn production at prices lower than the expenses incurred, i.e. 0.24 lei lower than the production cost in 2019, 1.29 lei in 2020 and 0.06 lei in 2021. It is necessary to emphasize also for this crop, in the respective years, this deficit in corn expenditure was covered by the operating subsidies received by the vegetable farm analyzed, but in 2020 losses were recorded for this crop.

**Regarding the gross product achieved per hectare cultivated with alfalfa**, it is noted that the most unfavorable situation is recorded in 2020, with a gross product located at a level of 43.42% compared to that recorded in 2019 and at 47 .20% compared to the gross product of 2022 (Fig. 9).

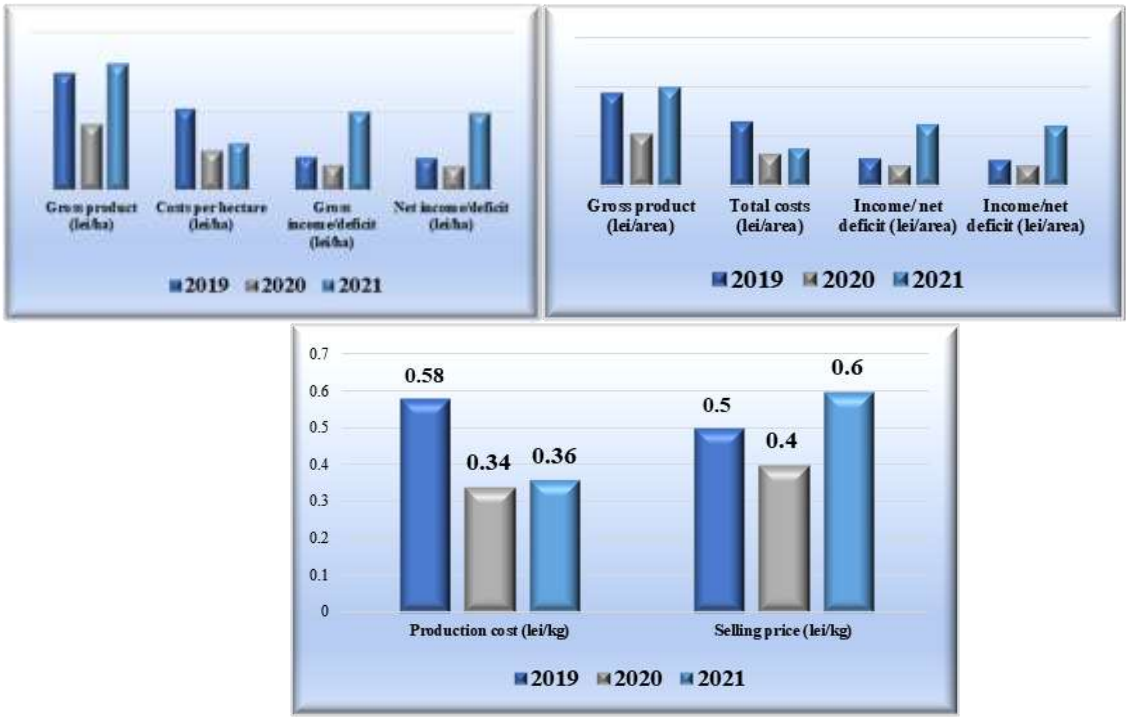


Fig. 9. Economic indicators per ha, per total area and production cost and recovery cost evolution for alphaalpha 2019-2021

Source: Results obtained from data processing from Interview Guide addressed to small scale vegetable farming.

Production expenses per hectare registered an oscillating trend during the analysis period, with a decrease of 51.16% in 2020 compared to 2019 and an increase of 18.27% in 2021 compared to 2020. Total expenses on culture of alfalfa also had an oscillating evolution, taking into account that the area cultivated with alfalfa was constant. Considering the small productions in 2020, the small-scale vegetable farm recorded a deficit in the alfalfa crop that could not be compensated even by the subsidies received. The best year for the alfalfa crop in terms of income was 2021, with a net income that exceeded by 199.39% the net income achieved in 2019. The production cost of alfalfa had the highest value in 2019, i.e. 0.58 lei compared to 0.34 lei in 2020 and 0.36 lei in 2022, good agricultural years in which the small-scale vegetable farm obtained quantitatively significant productions. Regarding the alfalfa recovery price, it is noted that, in 2020 and 2021, the lucerne recovery price exceeded the production cost by 0.06 lei/kg and 0.24 lei/kg, respectively. In 2019, the agricultural company capitalized on alfalfa production at a lower price than the expenses incurred, i.e. 0.08 lei/kg less ( Fig. 9).

**Regarding the gross product made on each hectare cultivated with bell peppers**, it is noted that in 2020 an unfavorable economic situation is recorded with a gross product

located at a level of 127.78% compared to that recorded in 2021. Production expenses per hectare registered an upward trend during the analysis period, experiencing an increase of 0.57% in 2021 compared to 2020. The total expenditure on donut culture followed the same trend, with an increase of 50.85% in 2021 compared to 2020.

Considering the fact that the production was small in 2020, the small vegetable farm recorded a deficit in the culture of bell peppers, a deficit that could not be compensated by the subsidies received. The production cost of the bell pepper crop decreased in 2021 compared to 2020, against the background of quantitatively large productions, and was 1.8 lei compared to 4.79 lei in 2020. Regarding the capitalization price at bell paper, it was mainly influenced by the market and was lower than the production cost by 2 lei/kg, in 2020 and 1.7 lei/kg in 2021, which shows that the agricultural society did not cover the expenses incurred on the donut culture from the revenues achieved through capitalization (Fig. 10).

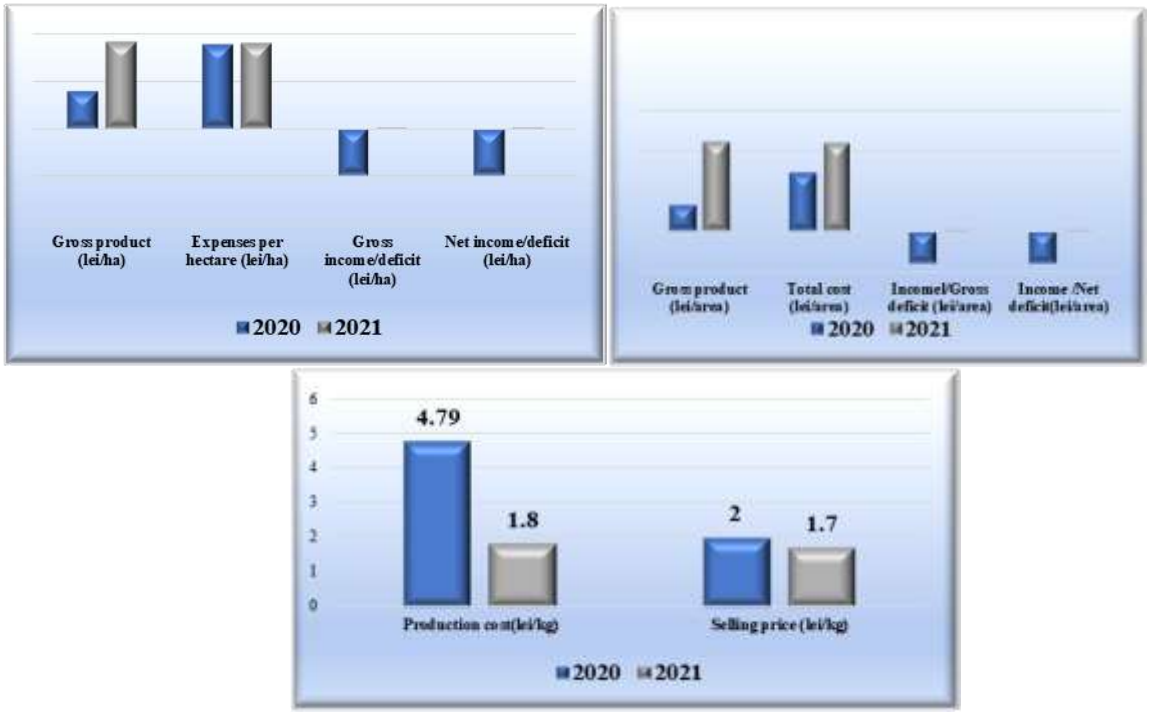


Fig. 10. Economic indicators per ha, per total area and production cost and recovery cost evolution for bell pepper 2020-2021

Source: Results obtained from data processing from Interview Guide addressed to small scale vegetable farming.

**Regarding the gross product made on each hectare cultivated with watermelon**, it is noted that in 2021 there is an unfavorable economic situation for this crop with a gross product located at a level of 8.61% compared to the one recorded in 2020.

Production expenses registered an upward trend during the analysis period, registering an increase of 2.88% in the year 2021 compared to the year 2020.

Considering the small productions in 2020 and 2021, the small-scale vegetable farm recorded a deficit in the melon crop, a deficit that it could not compensate from the subsidies received. The production cost of the watermelon crop decreased in 2021 compared to 2020, against the background of quantitatively small productions, i.e. 1.47 lei compared to 2.4 lei in 2020. As for the recovery price of watermelons, notes the fact that it was significantly lower than the cost of production by 0.5 lei/kg in 2020 and 0.2 lei/kg in 2021.

The agricultural company capitalized on watermelon production at prices lower than the expenses incurred, thanks to to an existing surplus at the county, regional and national level, the phenomenon of oversaturation of

the market intervened, and demand and prices decreased ( Fig. 11).

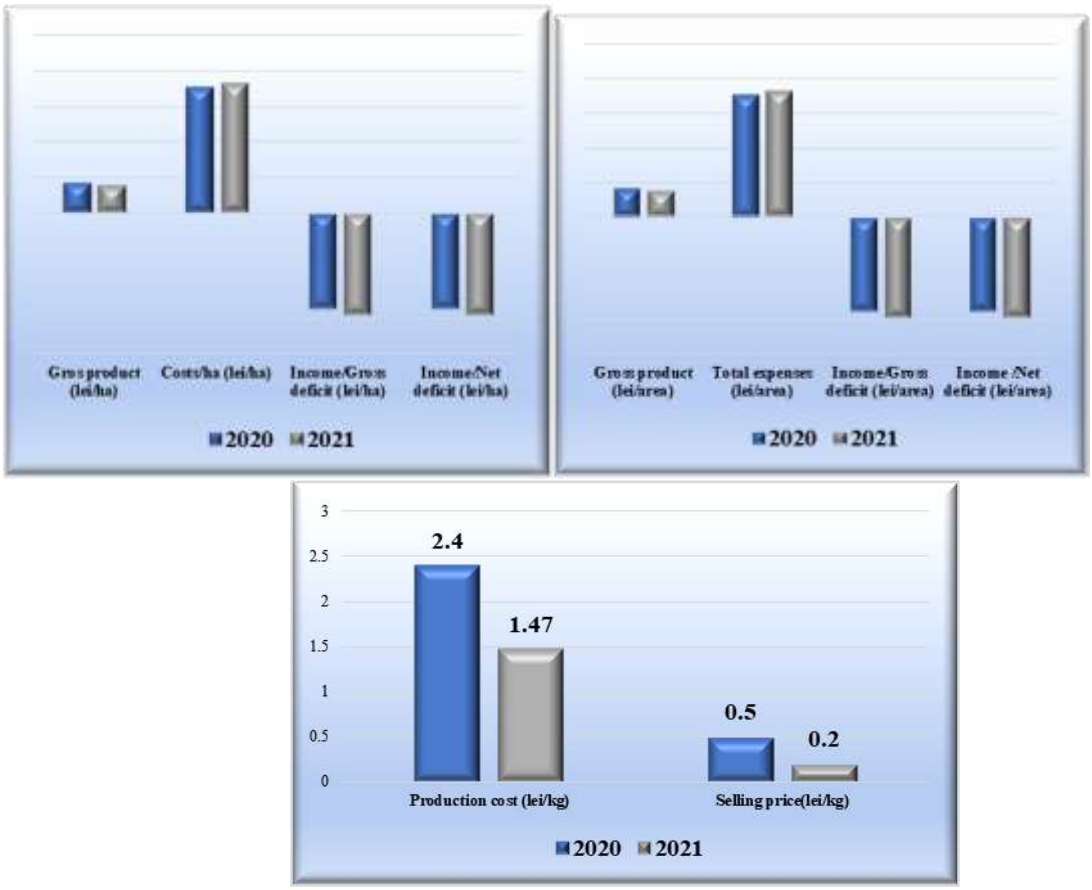


Fig. 11. Economic indicators per ha, per total area and production cost and recovery cost evolution for watermelon 2020-2021
Source: Results obtained from data processing from Interview Guide addressed to small scale vegetable farming.

**The patrimony situation** of the existing small-scale vegetable agricultural holding as a result of the economic carried out activity, was analyzed based on the accounting balance sheet, as the main monitoring and evaluation tool.

In the framework of the small-scale vegetable farming operation, we note that the ***rate of fixed assets*** had a large share in the total assets in 2018, the year of establishment, respectively 68.15%, the year in which the agricultural company laid the foundations of the technical equipment necessary for long-term development of the activity. A large share of these fixed assets (55.59%) is also noted in 2020, an agricultural year in which the value of current assets decreased compared to the previous year and in which financial losses were recorded. The years 2019 and 2021 registered an increase in the share of current assets in total assets, the rate of current assets being 53.50% (year 2019) and 58.96% (year 2021) against the background of the increase in its constituent elements: stocks, receivables and availability money and an efficient economic activity.

***Regarding current assets***, their analytical ratios are operational for the decision process. The inventory ratio has oscillating values from one year to another. In 2019, we note the share of 34.56% of stocks in total current assets, and in 2021 of 34.70%, which means that an increase in the volume of activity generates a justified increase in stocks and vice versa (in the years 2018 and 2020 register weights of 16.52% and 27.31%, respectively, of stocks held in total current assets).

Also, ***the interpretation of the inventory ratio*** during the analysis period is correlated with the level of activity: the increase in turnover must be higher than the increase in

the value of the inventory, and the slowing down of inventory turnover or the formation of non-moving or slow-moving inventory has a negative connotation on the activity the small-scale vegetable farm, in view of the difficulties of transforming them into liquidities, with negative consequences on solvency [13].

***The rate of trade receivables*** is dependent on the nature of the relationships of the small-scale vegetable farm with the external downstream partners as well as the payment terms they grant to them. We note that in 2018, this rate had the highest weight of 82.46% in total current assets, decreasing in 2019 to 55.99%, a decrease that is based on better relations with its customers, and the establishment a balance in commercial relations with third parties. The year 2020 brought an increase in this rate against the background of the significant decrease in the stocks held but also in the existing cash availability. It is noted that, in 2021, the reduction of the receivables rate is possible on the basis of their collection at maturity as well as on the basis of the increase in the weight of the stocks held.

***The rate of cash availability*** reflects their share in the total current assets owned by the small-scale vegetable farm. The high value of cash availability in 2021 reflects a favorable situation in terms of financial balance. But cash availability can have wide variations in very short intervals: receipts can increase greatly due to large subsidy receipts or trade receivables, or they can decrease as a result of very concentrated payments, especially during periods of crop establishment and during the application of the technology.

To analyze ***the efficiency of the use of the current assets*** owned by the small-scale vegetable farm, it is determined how they rotate every year to achieve the turnover. Thus, regarding the way in which current assets contribute to the turnover, we find that in 2018 they rotate slowly, respectively 0.13 times or every 2804.12 days and in 2020 by 1.01 times, respectively at 356.80 days. Analyzing the number of rotations of the components of the current assets in the turnover, the highest number of rotations has the cash availability, respectively 12.70 circuits in 2020, respectively 28.35 days and in 2018, 12.58 circuits, respectively 28.61 days. In 2020, stocks recorded the highest number of rotations in turnover, respectively 3.69 circuits, representing 97.45 days, and in 2021, receivables recorded a maximum number of 4.59 circuits, respectively 78, 49 days.

***The equity or financial resources attracted from the owners*** (the sole partner for the small-scale vegetable farming operation) as well as those constituted by the profits obtained from a profitable activity, represent the residual right or interest of the owner of the patrimony over the assets of the company, after deducting all debts this one.

The equity formed at the beginning of the agricultural company's activity can change, by increasing or decreasing, an aspect that we will analyze further. In the case of the sources of financing of the small-scale vegetable agricultural exploitation, the structural ratios of the balance sheet liability are of particular importance, importance given by the evolution over time of own financing, both of the nominal ones (share capital) and of the non-nominal ones (accumulated capital as as a result of profitable economic activity as well as foreign financing).

***The financial stability rate*** reflects the link between the permanent financial resources available to the vegetable farm and the total resources. The percentage of 60% is considered optimal for this indicator. In the case of the small vegetable farm, we note that, in the first year of operation, i.e. 2018, it has poor financial stability, due to negative equity, against the background of the recorded loss, this indicator being far below the level considered optimal. But, starting from 2019, the value of this indicator starts to increase, the year with the best quote being 2021, the year with a share of permanent capital in total liabilities of 41.92%. In order to maintain an optimal level of financial stability, it is necessary to increase the volume of permanent capital, especially by increasing the own capital held, by the small-scale vegetable farm.

***The financial autonomy rate*** expresses the degree of financing of the asset elements based on own resources, or in other words, the indicator indicates what percentage of the financing sources belong to the owner. It is appreciated that a large share of the own sources held in the total funding sources highlights a high financial autonomy. We will assess the financial autonomy of the small vegetable farm based on the following indicators: overall financial autonomy and term financial autonomy.

***The global financial autonomy*** reflects the weight of own sources of financing in the total sources of financing, being useful in the situation where the small-scale vegetable farm will request a bank loan, the information provided being related to its financial independence. We find that, during the analysis period, the indicator has values below 30%, which suggests that the small-scale vegetable farm does not present sufficient guarantees to obtain financing through bank lending. The loss from the financial years 2018 and 2020 significantly reduced the equity capital and its coverage from the profit of the following years, led to the recording of non-compliant values for this indicator, which convey to the management information for an immediate increase in the equity capital.

Thus, the increase in the share of equity capital in the balance sheet liability would have beneficial effects on total financial autonomy, namely higher equity capital, leading to better overall financial autonomy.

***The global indebtedness rate***

Term financial autonomy reflects the extent to which long-term debts participate in the formation of permanent resources. Its evolution within the small-scale vegetable farm is oscillating and justified by the decrease in equity against the background of the losses recorded in the 2018 and 2020 financial years, but also by the increase in medium and long-term debts.

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Turnover | 11,500 | 118,358 | 145,467 | 317,922 |
| Revenue from sold production | 11,500 | 118,358 | 145,467 | 317,922 |
| Revenues related to the cost of product stock | 14,769 | 9105 | 199,874 | 69,852 |
| Income from operating subsidies | 0 | 95,622 | 16,027 | 196,968 |
| Other operating income | 5656 | 33,934 | 64,351 | 33,934 |
| Operating income - total | 31,925 | 257,019 | 425,719 | 618,676 |

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Raw materials and consumables expenses | 18,718 | 100,099 | 202,787 | 196,696 |
| Other material expenses | 895 | 12,947 | 7819 | 19,405 |
| Other external expenses | 18 | 3518 | 11,664 | 3356 |
| Value adjustments regarding tangible assets | 5656 | 38,572 | 48,003 | 58,727 |
| Other operating expenses | 11,324 | 61,074 | 250,188 | 181,739 |
| Operating expenses - total | 36,611 | 216,210 | 520,461 | 459,923 |

Fig. 12. Income and expenses structure 2019-2021

Source:

Balance sheet and profit and loss account of the small scale vegetable farming.

Referring to the general principle of the indicator, i.e. the one in which the situation is favorable, for small-scale vegetable farming this indicator must show a permanent growth trend, a situation that the agricultural company can achieve by increasing its own capital and reducing debts in the long term, situation highlighted in 2021 within the analysis period. The global indebtedness rate expresses the level of debts of the vegetable farm in relation to the total sources of financing. The maximum allowed value of this indicator is 66%, and a value of 50% has safety connotations. The global indebtedness rate recorded rising values during the analysis period, due to the faster increase in the volume of total debts compared to that of total liabilities. In 2020, the indicator is approaching the maximum allowed level so that, in 2021, it will be close to the 50% threshold, a threshold considered safe. We believe that measures are required to reduce

the long-term debts that will be incurred, by renegotiating with suppliers for lighter payment terms, without affecting their management.

***In the structure of the revenues*** achieved by the small-scale vegetable agricultural exploitation, we note the composition of the turnover, formed, in its entirety, from the revenues from the sold production, representing 34.16% of the total revenues in 2020 and 51.38% in 2021 Along with the turnover, we note the existence of revenues related to the costs of product stocks with a weight of 46.94% in 2020 and 3.54% in 2019 in the total revenues achieved.

We note the contribution of income from subsidies to the formation of total income, with weights of 37.59% in 2019 and 31.83% in 2021.

***As for expenses***, the preponderance of expenses with consumable materials, which refer to seed and planting material, is noteworthy, fertilizers and plant protection products, fuels, as follows: 51.12% in 2018, 46.30% in 2019, 38.96% in 2020 and 42.76% in2021 from the total annual operating expenses. An important contribution to the formation of operating expenses is also made by value adjustments regarding tangible assets, with weights of 15.44% (2018), 17.84% (2019), 9.22% (2020) and 12.76% (2021).

In order to validate the quality of managing the activity within the small agricultural holding, ***the rate of commercial profitability*** was determined, which highlighted that in 2018 (-48.92%) and 2020 (-52.68%), the commercial activity was unprofitable, an imposed situation of recording losses. The years 2019 and 2021 the positive values of the rate of commercial return mean a commercial return and an increase in the market image of small-scale vegetable farming (in 2019, 43.78% and 52.34% in 2021).

***The rate of economic profitability*** reflects the ratio between the surplus or the gross deficit from exploitation and the economic means employed to obtain it, bringing advantages in the analysis, because it is independent of the financial structure of the small-scale vegetable agricultural exploitation, the fiscal policy of the state through which the income is taxed such as and the policy regarding the depreciation of fixed assets. At the level of small-scale agricultural exploitation, this rate has negative values, in 2018 (-1.67%), with connotations of unprofitability of the use of the total assets held, and in the following period, namely the financial years 2019-2021, ***the profitability of the use of economic assets*** held in order to obtain the gross surplus from exploitation increases: 16.30% (in 2019), 28.46% (in 2020) and 65.36% (in 2021).

***The financial profitability rate*** expresses the efficiency of the sole partner's capital investments and how to maintain them, taking into account the net result of the financial exercise and the owned equity. Through this rate, we assess the position of the small-scale vegetable farm on the market, as follows: the activity in the years 2018 and 2020 is unprofitable from a financial point of view, with recorded losses and negative equity (in 2018), but we note a recovery in the years 2019 and 2021, period in which the value of the financial return was 111.70% (year 2019) and 118.83% (year 2021) against the background of the increase of both the net profit and the owned equity.

We appreciate that by increasing the remuneration of invested capital, accessibility to new financial resources is facilitated, thanks to the confidence of the sole associate to reinvest, but also through the existence of the possibility of attracting other potential investors to the business, with implications for the future development of the agricultural society.

Highlighting ***the consumption of resources*** is done by recording them in the expense accounts, and to assess their efficiency, the balances of these accounts are reported to the results obtained.

In the framework of small-scale vegetable farming, ***the rate of return on consumed resources or costs*** - an indicator directly influenced by the financial result of the exploitation activity, with oscillating evolution during the analysis period - has negative values in 2018 (-14.96%) and 2020 ( -14.72%), which denotes an unprofitable operation that could not compensate for the operating expenses, but also positive values in

the years 2019 (23.96%) and 2021 (36.18%), which denotes the profitability of the operating expenses exploitation carried out (Fig. 13).


Fig. 13. Returns rate 2019-2021
Source: Own results based on the financial data of the small scale vegetable farming

***In order to establish the financial position of the small vegetable farm***, we analyzed the resources available to it, the activity carried out, the investments made as well as its patrimonial structure, and the following indicators will be presented below.

***The net balance*** is the accountant's estimate of the value of the rights that the owner of the small-scale vegetable farm holds and reflects how the business has been managed. This indicator expresses in terms of value, the realizable asset at a given time, or in other words, the value of the assets owned by the company, as well as the amounts due to the sole shareholder in case of liquidation.

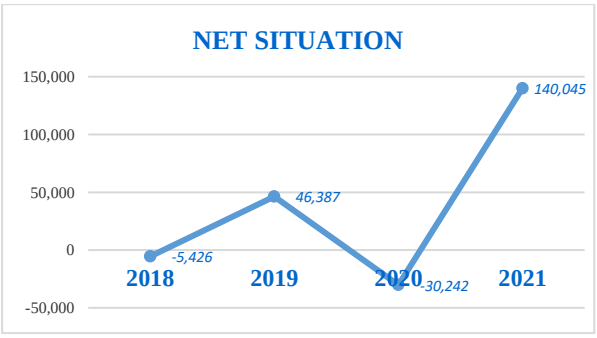


Fig. 14. Net situation
Source: Own results based on the financial data of the small scale vegetable farming.

In the case of this small vegetable farm, we note that, between the years 2018 and 2021, the net situation has the following evolution: it is positive in the years 2019 and 2021 and negative in the years 2018 and 2020, which highlights an oscillation in the way how the business was managed, from an economic point of view. The year 2018, the year of the establishment of the agricultural enterprise and the year 2020, the financial year with negative financial results, highlight a faulty management, completed with the decrease of the wealth of the sole associate. The recovery of the net situation took place in 2021, the year in which the deviation becomes positive and significantly increases compared to the previous year, thus fulfilling the main objective of the management: increasing the wealth owned by the small-scale vegetable farm.

***Working capital*** is an indicator of long-term financial balance that checks the financing of assets with a duration of more than one year from resources with a maturity of more than one year, or in other words the confrontation of permanent resources (equity and long-term liabilities) with permanent allocations (fixed assets).

Within the small-scale vegetable farm, the working capital, i.e. the part of the permanent capital remaining at the disposal of the agricultural company after the financing of fixed assets, is negative in the period 2018-2020, which indicates that the company failed to ensure an optimal financial balance (Fig. 15).

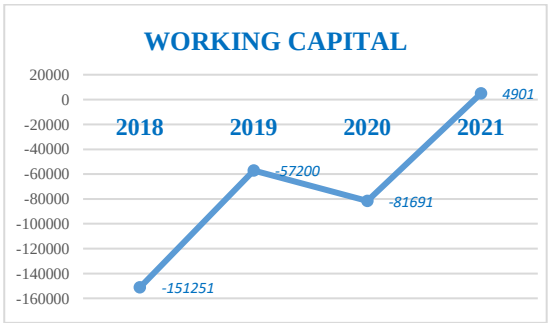


Fig. 15. Working capital
Source: Own results based on the financial data of the small scale vegetable farming.

In 2021, the working capital has a positive value, which denotes the fact that the financial sources attracted in the long term cover the investment needs of the company, releasing a surplus of resources that can be used to finance its other activities.

***The working capital requirement*** characterizes the short-term financial balance and presents the situation of the short-term financial needs (allocations) of the small-scale vegetable farm compared to the short-term attracted resources.

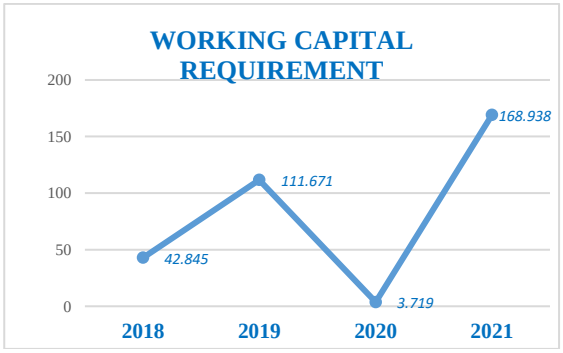


Fig. 16. Working capital requirement
Source: Own results based on the financial data of the small scale vegetable farming.

During the analysis period, namely the financial years 2018-2021, the working capital requirement of the small-scale vegetable farm shows positive values, higher in 2019 and 2021 and lower in 2020 and 2018, which means that the company has short-term additional allocations compared to resources drawn on the same term. Practically, the financing of short-term needs is carried out either on account of the working capital or on account of short-term credits. The deviation of the working capital requirement is negative in 2020 compared to 2019, a situation justified by the unfavorable results of 2020, a year in which operating debts approach the level of operating needs (allocations) (Fig. 16).

***Net treasury*** is the indicator that ensures the balance between the balance resources and uses, through which it is highlighted at the level of the small-scale vegetable farm whether the activity was balanced and efficient or not.

In the case of small-scale vegetable farming, the net treasury registered negative values throughout the analyzed period and highlights an unfavorable situation, which signifies a financial imbalance and brings indications of a dependence of the agricultural society on external financial resources (Fig. 17).

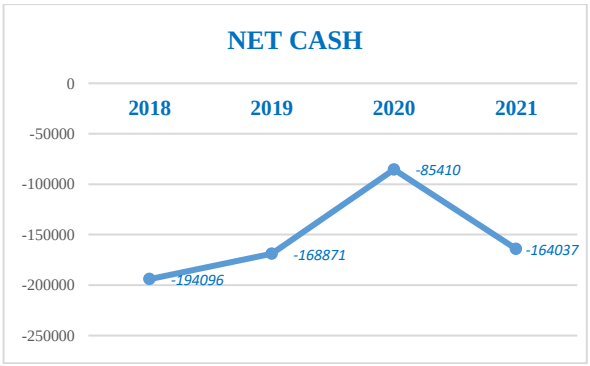


Fig. 17. Net cash
Source: Own results based on the financial data of the small scale vegetable farming.

***Cash-flow or treasury flow*** ensures the health of the small-scale vegetable farm business and must be managed correctly, because without cash availability, it can become insolvent and even bankrupt. The cash-flow, differentiated by category (operational cash-flow, investment cash-flow and financing cash-flow) is determined as the difference between the existing cash inflows and outflows within the small vegetable farm during each financial year, from the analyzed period, is a very important indicator and refers to the monetary surplus or deficit released by its annual activity [2].

We find that in the years 2019 and 2020, cash-flow is positive, which indicates that liquidity inflows are higher than outflows, (receipts > payments) the situation characterized as favorable. In the year 2021, cash-flow is negative (receipts < payments), which

suggests that cash outflows exceed inflows and there is a cash deficit (Fig. 18).

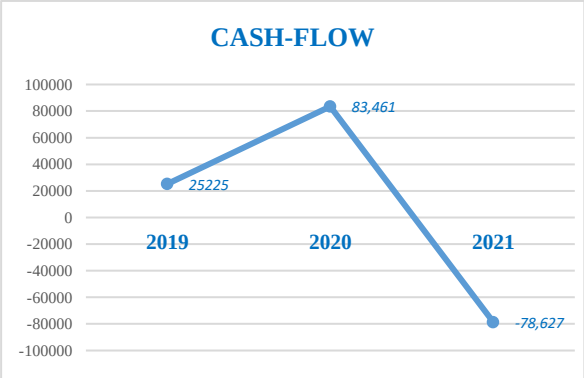


Fig. 18. Cash-flow
Source: Own results based on the financial data of the small scale vegetable farming.

***The credit worthiness*** of the small-scale vegetable farm refers to its liquidity and solvency in the analyzed time frame, namely the financial years 2018-2021.

Liquidity refers to the ability of the small-scale vegetable farm to honor its short-term debts (current liabilities) on account of short-term assets (current assets). For details, the following indicators were determined: current or general liquidity, quick liquidity or the acid test and immediate or sight liquidity.

***Current or general liquidity*** represented by the company's ability to honor its short-term obligations based on all short-term assets, respectively based on stocks, receivables and existing cash availability. We notice a downward evolution of the indicator during the period under analysis, the only year with optimal framing of the indicator being the year 2021 (optimal interval being considered between 1 and 2), but for the period 2018-2020, the value positioning above the upper limit of the optimal interval signifies a surplus of current assets of the nature of stocks, receivables and cash in relation to current liabilities. It is recommended to negotiate lighter payment intervals with suppliers, up to the limit of their acceptability and satisfaction, as they are beneficial for small-scale vegetable farming, taking into account that they are not interest-bearing. Quick liquidity, or the acid test, represents the ability of the company to honor its short-term obligations (current liabilities) based on short-term assets (receivables and cash availability), excluding inventories.

We notice a downward evolution of the indicator during the period under analysis, but the value positioning at the level of the entire period is substantially above the upper limit of the optimal range (0.6-1), which means a surplus of current assets of the nature of receivables and availabilities in relation to current liabilities. It is recommended to expedite the collection of some customers, of course, without pressure on them, in order to obtain the cash availability more quickly and place or invest it.

***Immediate or spot liquidity*** represents the ability of the company to honor its short-term obligations (current liabilities) based on short-term assets, excluding stocks and receivables, respectively on account of available assets held at that time. We notice an oscillating evolution of the indicator during the period under analysis, in the years 2018 and 2020 the indicator is positioned below the level of the optimal range (0.2 - 0.6), which means a shortage of cash availability and in the years 2019 and 2021 it is positioned in the range optimal reference and even outside the upper limit for the year 2021, which means a surplus of current assets of the nature of liquidity in relation to current liabilities.

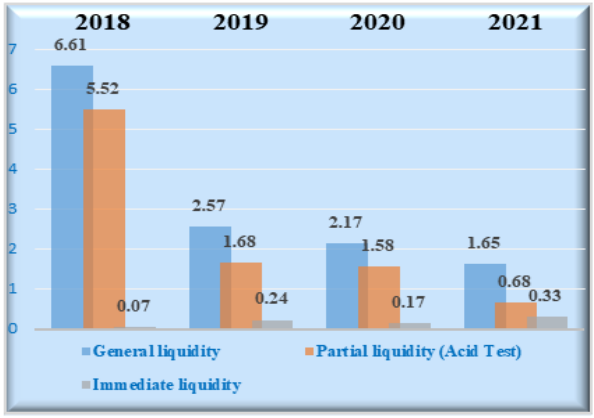


Fig. 19. Liquidity
Source: Own results based on the financial data of the small scale vegetable farming.

***Solvency*** is the company's ability to meet its total liabilities against its total assets. We notice an oscillating evolution of the indicator during the period under analysis, but the value

positioning at the level of the entire interval is above the upper limit of the safety threshold of 1.66, which signifies a non-existent risk of insolvency/bankruptcy. A perpetuation of the company's debt management system is recommended, as it proves to be an effective one [6].

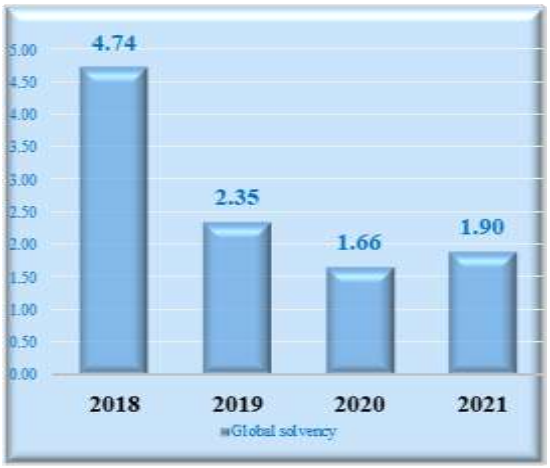


Fig. 20. Solvency
Source: Own results based on the financial data of the small scale vegetable farming.

## CONCLUSIONS

It is becoming more and more evident that small-scale horticultural holdings are the most vulnerable to climate changes category of holdings. The support achieved through the macro-economic policy of subsidizing agriculture is essential for the survival of these activities. For the small-scale agricultural holding under study, it is recommended to improve the structure of the assets by increasing the percentage of directly productive assets, reducing stocks as well as restoring financial autonomy, financial stability and the level of indebtedness. Taking into account that the financial performance of the small-scale vegetable farming operation fluctuated during the period 2018-2021, not having the ability to generate constant profit during the period included in the study, it is recommended to include in the rotation of some crops resistant to the new agrometeorological conditions imposed by regional climate changes. The profitability of the exploitation activity is greatly influenced by the revenues from the exploitation subsidies received, the value of the revenues from the agricultural production sold being small and insufficient, it is recommended to increase the value of these subsidies per hectare. Thus, 2018 and 2020, unprofitable years from an economic, financial point of view, with high committed expenses, had negative implications on commercial profitability and 2019 and 2021, were profitable years from an economic, financial and committed cost point of view, but we note the contribution of subsidies to profit generation. The small-scale vegetable farm has a fluctuating liquidity, but the solvency is generally downward, but it is positioned above the safety threshold limit, which places the small-scale vegetable farm at the shelter of insolvency.

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# PRODUCTIVITY OF COTTON VARIETIES AND EFFICIENCY OF IRRIGATION

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***Abstract***

*The study was conducted in the period 2018-2020 in the Training and Experimental Base of the Department of Plant Breeding at the Faculty of Agriculture of the Trakia University - Stara Zagora on soil type typical meadow-cinnamon soil in fertilizer experience in non-irrigated and irrigated conditions. The field experience is by the method of fractional plots in four repetitions with the size of the harvest plot 15 $m^2$ (1.80 x 8.34 m). The research factors are: irrigation (A), variety (B), fertilization rates (C) and meteorological conditions during the marketing year (E). The study was conducted with three varieties of cotton - Helius, Darmi and Isabell, with three levels of nitrogen fertilization - 80, 160, 240 and 0. The effect of irrigation on cotton productivity has been established. As a result of the conducted Polish research, it was established that the total yield of unginned cotton realized on average for the research was very good – 1,945.2 kg/ha. The average yield under irrigated conditions exceeds the yield without irrigation by 34%. The Darmi variety stands out as the most productive and promising compared to Helius and Isabell. The optimal nitrogen rate of the tested is $N_{160}$. When fertilizing with $N_{240}$, the yield shows a downward trend compared to $N_{160}$ and this fertilization is not effective. On average for the period, at the four levels of nutritional regime, the effect of 100 $m^3$ of irrigation water was established – 89.81 kg/ha. With the naturally coloured variety Isabel, the effect is the highest, on average for 4 levels of fertilization – 100.75 kg/ha.*

***Key words:*** *productivity, efficiency, cotton, irrigation, fertilization, yield*

## INTRODUCTION

Cotton is a valuable crop, which in terms of cultivated area in the world occupies the sixth place after wheat, rice, corn, barley and sorghum (the group of the main crop for the nutrition of mankind). In terms of total and net income per unit of area, it ranks in one of the first places. Cotton productivity varies greatly with moisture conditions during the growing season.

Deficit or regulated deficit irrigation is one way to increase water use efficiency for higher yield per unit of irrigation. The goal of deficit irrigation is to increase the efficiency of irrigation water use by reducing the amount of irrigation water or by reducing the number of irrigation events (Wu et al., 2010) [18]. Under deficit irrigation, crops are deliberately exposed to water stress, resulting in reduced yield (Igbadun et al., 2008; Zhang et al., 2017) [6, 21].

According to Saldzhiev and Raykov (2010) [12], the reduction of the irrigation rate of 120 mm for cotton by 25% and 50% does not lead to adequate changes in yield - the decline in these cases is respectively 9.20% (26.1 kg/da) and 12.50% (35.5 kg/day). By reducing the irrigation rate to 60 mm, the cost of irrigation is reduced to 62%, the net income of 100 $m^3$ of irrigation water is the highest, and the effect of 1 $m^3$ of water is the greatest.

The degree of desiccation affects the content of chlorophyll a, chlorophyll b and carotenoids, which is explained by their biological role to protect chlorophyll from photooxidation under stress conditions (Koleva and Vasilev, 2012) [8].

Shareef et al. (2018) [14] also recorded a decrease in leaf area index. Fiber length was also shortened in response to water stress, while fiber strength index, fineness, and uniformity were not affected by irrigation levels. The efficiency of drip irrigation has been studied in a large range of crops (Saldzhiev and Nikolov, 2005; Mahan et al., 2018; Saldzhiev et al., 2014; Stoyanova and

Valchev, 2018; Stoyanova et al., 2019) [11, 10, 13, 16, 17].

Research on the influence of fertilization with nitrogen fertilizer applied with irrigation water found that a reduction of the rates by 18.75% did not reduce the quantity and quality of yields and increased the efficiency of use of supplied irrigation water (Zugui et al. 2003; Aujla et al. 2005; Li et al., 2017) [22, 1, 9].

Yang et al. (2015) [19] consider the impact of the limited supply of irrigation water and its efficient use, in the context of global trends towards gradual warming and drying.

Investigating the impact of drip irrigation fertigation on the efficiency and productivity of cotton, Jayakumar et al. (2015) [5] found the positive influence of drip fertilization on crop potential and soil fertility.

Aujla et al. (2005) [1] concluded that a reduction in the amount of water applied leads to a reduction in the agronomic efficiency of nitrogen. Drip irrigation increases the agronomic efficiency of nitrogen application compared to gravity irrigation.

Stamatiadis et al. (2016) [15] found that reduced water supply causes a change in the distribution of N in plants, with seeds absorbing nitrogen to the highest extent under water stress conditions.

Optimizing fertilization and irrigation in agricultural crops is a feasible production practice for optimal economic results.

The main objective of the present study is to investigate the productivity of cotton varieties under drip irrigation conditions, as well as the efficient use of water resources.

## MATERIALS AND METHODS

The field experience was brought to the experimental field of the Faculty of Agriculture at Trakia University, Stara Zagora. The soil is meadow-cinnamon soil, medium sandy-loamy. The power of the profile is 103-105 cm, with well-formed horizons. The humus horizon is clearly expressed with limits of 0-45 cm. For the root-inhabited layer 0-60 cm, the soil is characterized as having an average humus content of 2.08-3.00%.

The experiment was set up using the method of fractional plots in four repetitions with the size of the harvest plot 15 $m^2$ (1.80 x 8.34 m). The object of the study are three cotton varieties: two with white color (Hemus and Darmi) and one with natural brown colored fiber (Isabell).

The field study was carried out under irrigated and non-irrigated conditions at four fertilization levels. The volumetric mass for the surface soil layer is 1.07 g/m³ and reaches 1.34 g/m³ in the 60-80 cm layer. The relative density is 2.65-2.72. The average marginal field moisture content in the 0-40 cm layer is 31.6%. Irrigation was carried out with a drip irrigation system with built-in drippers at 0.15 m, with an irrigation rate of 150 mm when the soil moisture was below 75% of the RH for the layer 0-50 cm. Soil moisture dynamics were measured periodically with a soil moisture probe.

The rates of nitrogen fertilization for cotton are 0; 80; 160 and 240 kg/day. Nitrogen as $NH_4NO_3$ for cotton was applied once pre-sowing. The soil in the experimental area is characterized by a slightly alkaline to alkaline reaction with values for pH ($H_2O$) in the arable horizon of 7.7. In the arable layer 0-30 cm, the mineral nitrogen is in the range of 75.32 to 80.12 mg/1,000 g of soil, which corresponds to a good nitrogen supply of the soil. In terms of mobile phosphorus, the soil has low to medium reserves. In the 0-30 cm layer, its content is 4.01-5.12 mg/100 g of soil, and it slightly decreases in the lower soil layer. The content of mobile potassium in the layer 0-60 cm is 31.03-39.6 mg/100 g soil, which characterizes the soil as very well stocked with potassium.

## RESULTS AND DISCUSSIONS

***Agrometeorological characteristics in relation to the growth and development of cotton***The field experiment was conducted in the period 2018-2020 at a site with an altitude of 169 m and located at 42°41'51.75" N latitude, 23°19'18.722" E longitude. In terms of climate, the region falls into the European-continental region and the Transitional-continental subregion of it. The years of the

Polish study are meteorologically characterized by significant differences in measured mean diurnal temperatures by month compared to the multi-year period (1930-2020). The average annual temperature for the three-year period is 13.8°C (ranging from 13.6°C in 2018 to 13.9°C in 2020), which is 1.5°C above the multi-year average temperature values for the area (12.3ºC). For the period 1930-2020, an average of 565 mm of precipitation was recorded annually. Over the three years of the study, 672.0 were measured respectively; 477.0 and 574.6 mm. Rainfall is unevenly distributed over the cotton growing season (Fig. 1).

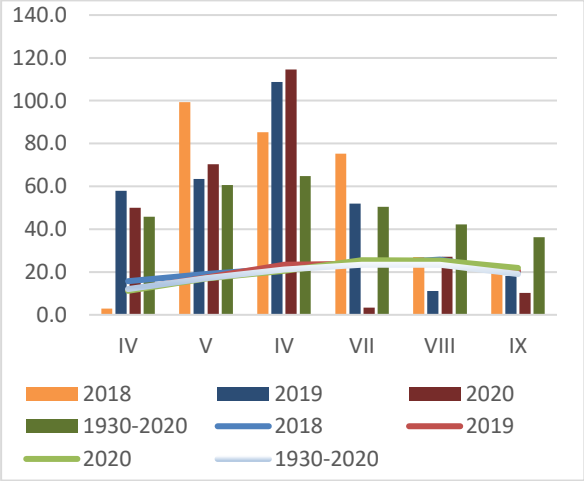


Fig. 1. Dynamics of precipitation and temperatures during the growing season
Source: Author's design.

In the first year, the total amount of rainfall for the months of June, July and August was 187.2 mm, with only 27 mm recorded in August. The average monthly temperatures for the city of April and May exceed the annual norm determined for a period of 90 years by 3.68 and 1.94 ºC respectively. Cotton vegetation occurs under favorable humidity and temperature conditions in the second year. The average monthly temperatures measured show an excess for all months compared to the average values, with the most significant differences in May (+1.94 °C), June (+2.27 °C), August (+1.83 °C) and September (+1.53 °C). The amount of precipitation in August was 11.2 mm, and due to the high temperatures, it was found that part of the ties were dripping. The last year is characterized as having the least amount of moisture and precipitation. This allowed to record the most significant differences in the growth and development of the plants during the phenological phases of the three tested cotton varieties in the irrigated and non-irrigated field. The high temperatures in July ($25.5^0$C) and the lack of precipitation caused a severe drop of buds and flowers.

A non-uniform distribution of precipitation was recorded for the growing season throughout the period of the field experiment. The water deficit coincides with the moisture critical flowering-early ripening period. This adversely affects the generative development and productivity of cotton, regardless of the fact that it is characterized as a relatively drought-tolerant crop.

***Productivity of cotton varieties***

Optimizing the nutritional and water regime is a prerequisite for the varieties to show their biological potential. On average for the period, the lowest yields were obtained in 2020, and the highest - in 2018, respectively by 16.8% and by 28.4% more than the yield in 2019 and 2020. The results establish a tendency towards increasing yields as fertilization levels increase. The lack of nutritional elements, according to Zeng et al. (2014) [20] arrested the development of cotton plants, reduced both the total raw cotton yield and the fiber yield.

Analyzes of the obtained yields show that the Darmi variety stands out with the highest yield of non-ginned cotton during the three experimental years (Figures 2 and 3). On average for the period, the yield of this variety was 1,790.2 kg/ha, exceeding the Helius variety by 8.5% and the Isabel variety by 5.05%. In 2018, 2019 and on average for the period, the Isabell variety showed a tendency to excel over the Helius variety with 4.9 respectively; 1.1 and 3.45%, and in 2020 its yield is lower at 3.84%.

On average for the period, $N_{160}$fertilization recorded the highest average yield in all combinations, except for the Isabel cultivar under non-irrigated conditions, where the yield was maximum when $N_{240}$ fertilization. When fertilizing with moderate levels of $N_{160}$, on average for the period, yields were formed

from 1,440.8 kg/ha in the case of the Isabel variety without irrigation to 2,179.1 kg/ha in the case of Darmi with irrigation.

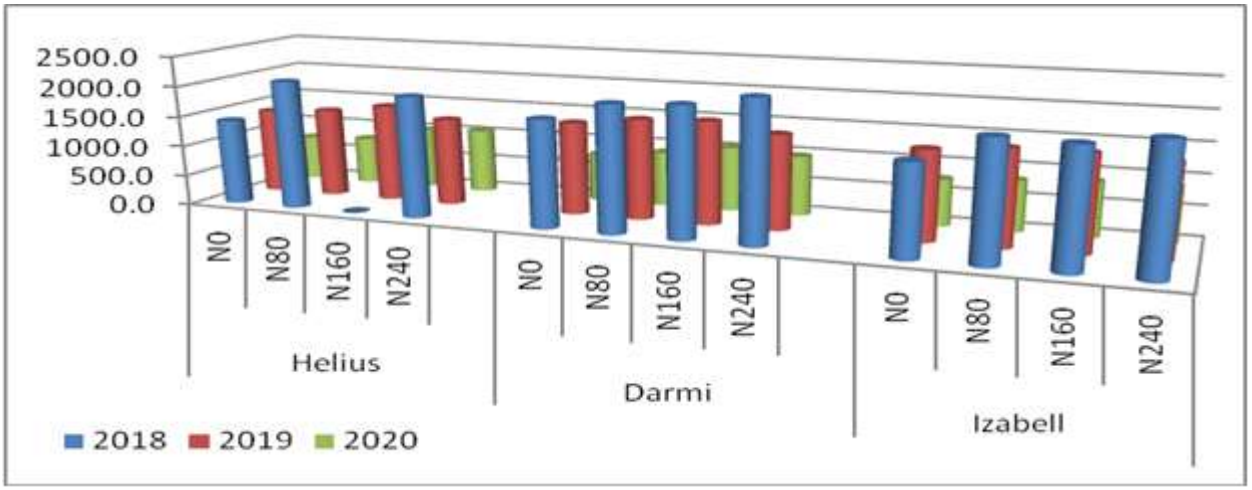


Fig. 2. Production under non-irrigated conditions
Source: Author's design and results.

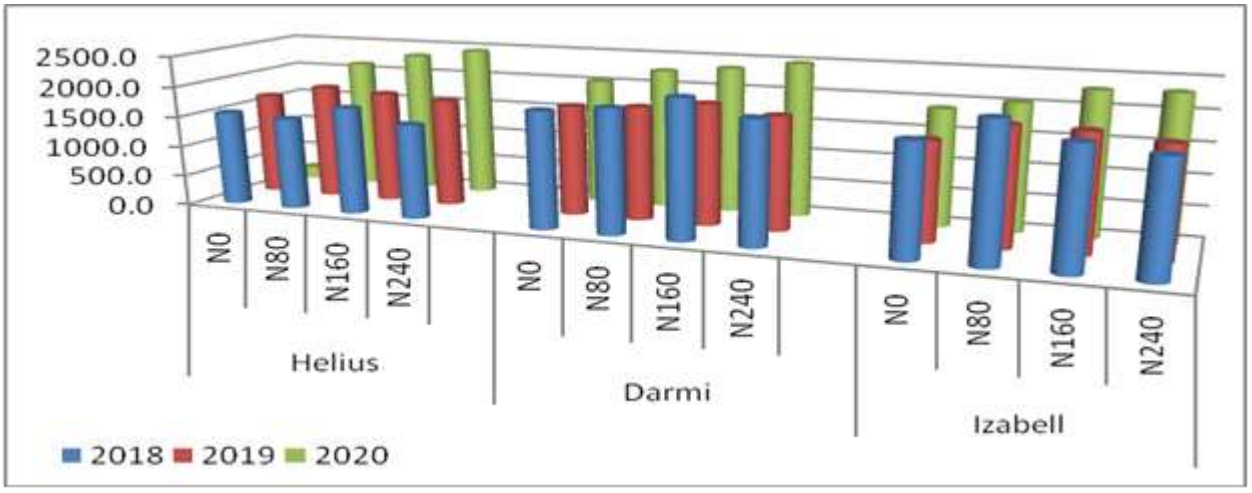


Fig. 3. Production under irrigated conditions
Source: Author's design and results.

Geng et al. (2015) [4] also reported that at the beginning of box filling, a high nitrogen rate may have a negative effect on raw cotton yield due to enhanced vegetative growth.

Over the three-year period, the lowest yields were obtained in 2020, and the highest in 2018, respectively 16.8% and 28.4% more than the yield in 2019 and 2020.

The large difference in yields in the three years confirms the strong influence of the environment - both temperature and humidity conditions.

Nitrogen fertilization of the cotton crop, especially under water deficit, is essential for recovery of growth and development from drought stress, according to Khan et al. (2017) [7].

Table 1 reflects the influence of the factors irrigation, variety and fertilization on the productivity of cotton.

The significant influence of the irrigation regime on the total yield of non-ginned cotton was established – 28.86% of the total influence of the factors, proven at $p \leq 0.1\%$.

***Irrigation effect***

Table 2 presents the parameters of the additional yield and the effect of 100 $m^3$ of irrigation water. The average irrigation rate over the three-year period is 7,500 mm.

Depending on the distribution of rainfall in the first year, two irrigations were

implemented, in 2019 – four irrigations, and in 2020 five irrigations were provided.

The parameters of the water used for irrigation in cotton (*Gossypium hirsutum* L.) are dependent on the climatic scenario, also confirm studies by Garcia-Vila et al. (2009) [3].

Table 1. Analysis of dispersion for total unginned cotton yield, average for 2018-2020, for the Stara Zagora region, Bulgaria

| Source of variation | Degree of freedom | Sum of squares | Effect of factor,% | Mean squares | Fisher's test | Probability level |
|---|---|---|---|---|---|---|
| Total | 71 | 165,995.8 | 100.00 | - | - | - |
| Blocks | 2 | 12,209.2 | 7.35 | 6,104.6 | 3.1 | n.s. |
| Variants | 23 | 64,335.8 | 38.76 | 2,797.2 | 1.4 | n.s. |
| Factor A-Irrigation | 1 | 47,907.8 | 28.86 | 47,907.8 | 24.6 | *** |
| Factor B - Variety | 2 | 2,387.2 | 1.44 | 1,193.6 | 0.6 | n.s. |
| Factor C - Fertilization | 3 | 10,252.2 | 6.18 | 3,417.4 | 1.8 | n.s. |
| A x B | 2 | 1,657.8 | 1.00 | 828.9 | 0.4 | n.s. |
| A x C | 3 | 190.2 | 0.11 | 63.4 | 3.3 | n.s. |
| B x C | 6 | 1,208.5 | 0.73 | 201.4 | 0.1 | n.s. |
| A x B x C | 6 | 732.0 | 0.44 | 122.0 | 6.3 | n.s. |
| Error | 46 | 89,450.8 | 53.89 | - | - | - |

*p ≤ 5%  ** p ≤ 1%  *** p ≤ 0.1%
Source: Author's results.

The results show that as a result of optimizing the humidity conditions, the yields increase by 25.4% on average.

The most responsive to irrigation on average for all levels of fertilization is the Isabell variety with 28.5%.

Darmi variety increased its productivity by 25.1%. The Helius variety is characterized by the highest environmental plasticity.

Under irrigated conditions, the production of unginned cotton increases by 21.6%. The highest additional yield under irrigation was registered with the naturally colored variety Isabell – 609.8 kg/ha.

The effect of 100 $m^3$ is calculated as the ratio between the additional yield and the amount of irrigation rate.

From the data, it can be seen that the effect of irrigation with 100 $m^3$ ranges from 52.78 to 110.87 kg/ha.

The Isabel variety (100.75 kg/ha) is distinguished by the highest effect. Irrigation, at a rate of nitrogen fertilization of 80, has contributed to obtaining an additional yield of 609.8 kg/ha at the size of the realized irrigation rate of 550 mm.

A high effect was also recorded with nitrogen 160. No trend was observed with the effect of irrigation water.

Cetin et al. (2002) [2] found that water logging resulted in lower overall cotton yield. The highest additional yield, as well as the highest effect of irrigation water at zero fertilization, was calculated for the Helius variety.

In the case of Darmi variety, the established additional yield at zero fertilization and with nitrogen 160 was 553.0 kg/ha and 565.6 kg/ha, respectively.

This also determines the close values of the effect per 100 $m^3$ – 100.55 and 102.84 kg/ha. In contrast, the Isabell variety has the greatest effect of irrigation water at nitrogen fertilization level 80.

Research by Li et al. (2017) [9] also found that reducing nitrogen rates did not reduce the quantity and quality of yields, but increased the efficiency of use of water supplied for irrigation.

Table 2. Irrigation parameters, productivity and effect of 100 $m^3$ of irrigation water for three varieties of cotton, 2018-2020

| **Variants** | | **Irrigation norm (M)** | **Yield (Y)** | **Additional yield (AY)** | **Effect of 100 $m^3$** |
|---|---|---|---|---|---|
| Variety | Fertilizer | mm | kg/ha | kg/ha | kg/ha |
| Helius | $N_0$ | 550 | 1,707.3 | 522.0 | 94.91 |
| | $N_{80}$ | 550 | 1,833.2 | 373.9 | 67.98 |
| | $N_{160}$ | 550 | 1,963.0 | 290.3 | 52.78 |
| | $N_{240}$ | 550 | 1,915.1 | 417.3 | 75.87 |
| | | **550** | **1,854.7** | **400.9** | **72.89** |
| Darmi | $N_0$ | 550 | 1,908.6 | 553.0 | 100.55 |
| | $N_{80}$ | 550 | 1,952.2 | 501.9 | 91.25 |
| | $N_{160}$ | 550 | 2,179.1 | 565.6 | 102.84 |
| | $N_{240}$ | 550 | 2,094.7 | 486.9 | 88.53 |
| | | **550** | **2,033.7** | **526.9** | **95.79** |
| Izabell | $N_0$ | 550 | 1,760.2 | 528.9 | 96.16 |
| | $N_{80}$ | 550 | 2,037.5 | 609.8 | 110.87 |
| | $N_{160}$ | 550 | 2,023.5 | 592.7 | 107.76 |
| | $N_{240}$ | 550 | 1,959.6 | 485.2 | 88.22 |
| **Average** | | **550** | **1,945.2** | **554.2** | **100.75** |
| **Average of the three varieties** | | **550** | **1,944.5** | **494.0** | **89.81** |

Source: Author's results.

## CONCLUSIONS

As a result of the conducted field research, it was established that the total yield of unginned cotton realized on average for the research was very good - 1,945.2 kg/ha.

The average yield under irrigated conditions exceeds the yield without irrigation by 34.0%. The Darmi variety stands out as the most productive and promising compared to Helius and Isabell. The optimal nitrogen rate of the tested is $N_{160}$. When fertilizing with $N_{240}$, the yield shows a downward trend compared to $N_{160}$ and this fertilization is not effective.

On average for the period, at the 4 levels of nutritional regime, the effect of 100 $m^3$ of irrigation water was established - 89.81 kg/ha. With the naturally colored variety Isabell, the effect is the highest, on average for 4 levels of fertilization – 100.75 kg/ha.

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# STUDY OF THE POSSIBILITIES OF FINANCING THE AGRICULTURAL SECTOR IN BULGARIA

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***Abstract***

*The need for government assistance in the external economy is necessitated by other economic uncertainties, the impact of agricultural activity on the environment, and especially low and irregular cash flows in the agricultural sector. The received state and European aid in the form of various economic losses are necessary for agricultural producers. Based on the financial resources provided, the company's financial condition is stabilized and improved. This embodies a management policy in the agricultural sector in Bulgaria. The aim of the study is to look for possible options for financing agricultural producers in Bulgaria. For the purposes of the study, the analyzed period is divided into several main groups according to Bulgaria's membership in the EU and implementation of the Common Agricultural Policy: Pre-accession, First program period (2007-2013), Second program period (2014). - 2020) and the Third Program Period (2021-2027). Financing in the Agricultural sector is divided into internal and external. Internal financing refers to lending by banks and support through national surcharges, through the granting of state aid. External financing is the financial means provided to farmers by the European CAP programs (ISPA, SAPARD, RDP). Based on the analysis, it is found that the liabilities of the agricultural firms are growing faster than the assets, as farmers use more loans than savings to cover their financial needs, the small producers of the sector (under 20 ha) face the most many difficulties in obtaining financing. Subsidies are mainly received from large and major firms, while small and medium-sized ones that really need these funds remain disadvantaged. The granting of subsidies is associated with economic losses and very complicated programs, the implementation of which is tied to high public costs.*

***Key words:*** *financing, subsidy, efficiency, agricultural sector, CAP, state intervention*

## INTRODUCTION

Bulgaria started implementing the Rural Development Program (RDP) as an instrument of the 2nd pillar of the Common Agricultural Policy (CAP) since the beginning of its membership in the European Union (EU). According to the definition of rural areas (municipalities in which the population density is up to 150 residents per 1 sq. км., with no settlement having a population of more than 30,000 people), more than 80% of Bulgaria's territory is classified as rural, where nearly 40% of the population. The development trends of these areas are in the direction of deepening the differences in terms of demographic processes, economic development and access to basic services with urban areas. Businesses and rural residents face problems related to low productivity, poor product quality and difficulty competing with imported products. These processes predetermine low incomes, high unemployment and poverty. The population in rural areas is decreasing, and its age structure is constantly deteriorating. The preservation and development of rural areas depends on the preservation and attraction of human capital, development of local entrepreneurship, etc. According to Aizenman (2006) [2], there are multiple factors that influence the economic cycle of any national economy. He believes that economic development is a non-linear process and there is no single criterion for evaluating its effectiveness. In developing countries, market defects are greater and the state's ability to deal with them is smaller, Stiglitz (2014) [15] concludes. It defines five key roles of the state: promoting education; promoting technologies supporting the financial sector; infrastructure investments; preventing environmental degradation and creating and maintaining a social safety net. Many economists are opposed to policy

intervention, in industry for example, as they believe it disrupts the functioning of the market, leading to a general loss of the country's wealth due to government failures. The application of the EU's CAP with its social function is an example of non-compliance with liberal economic theory, it is in complete opposition to it (Andonov, 2012) [3]. Reasons for state intervention, except through strategic production, are the dependence on environmental and climatic conditions, the threat of the spread of diseases and enemies on crops and animals, a large time difference between investing capital and obtaining production, the dependence of production on limited resources, for example, agricultural land, population growth and changing food habits (Blazheva, 2013) [4].

According to data from the National Plan for the Development of Agriculture and Rural Areas under the Special EU Accession Program in the Field of Agriculture and Rural Areas (SAPARD) [16] from 2007, when Bulgaria joined the EU, the financing options also changed to farmers. After the acceptance of the country into the European community, a significant influence on the development of agriculture was exerted by both internal and external factors, not only (Mishev et al., 2009). [10]. That opinion is also shared by Nikolova (2007) [11], according to her only since 2007 Bulgaria has the actual opportunity to receive financial resources from the funds and to be fully included in the European family. The question of how useful it really is to society and to what extent its role should be implemented. In fact, it helps producers in the agricultural sector as much as it harms them. For example, accepting EU subsidies burdens farmers with many administrative duties, and they also have to make commitments on environmental protection, animal welfare, rural development and risk management. Commitments that overwhelm them and sometimes are overwhelming and lead to the opposite process - refusal of this help.

## MATERIALS AND METHODS

Financing in the Agricultural sector can be internal and external. Internal financing refers to lending by banks and support through national surcharges, through the granting of state aid. Over the years, several Ordinances have been promulgated that regulate the conditions for national supplements (Ordinance No.3 of 25.02.2009; Ordinance No.2 of 21.02.2011; Ordinance No. 1 of July 12, 2022) [13,14, 15].

A disadvantage of these forms of support is the limited nature of their application and the insufficient amount of financial resources. Compared to national supplements, according to Boshkilov (2017) [5], the levels of financial support through state aid is about 3 times lower, and compared to the levels of external financial support through the financial instrument Single area payment scheme (SAPS), it is about 8 times less. External financing is carried out through the SAPARD and RDP programs. After some time, a distortion of the effect of implementing the program, for the conditions of Bulgaria, began to be reported. Small businesses and farms could not get involved in the absorption of the funds, notes Boshkilov (2017) [5] in his studies. However, the implementation of the program helped to gain experience in working with European funds. To a great extent, the financial means indicated by the EU through the CAP have a strong influence on the development of agriculture in Bulgaria. The CAP provides financial support without being directly tied to production. Direct payments are organized as decoupled payments per unit of area intended to support farmers' incomes and represent a major share of the entire CAP budget (Ivanov, 2020) [9]. The main form of support to farmers with direct payments is through the SEPP and through this scheme the most important financial resource in agriculture is distributed, targeting the main share of beneficiaries.

## RESULTS AND DISCUSSIONS

### *Pre-accession period*

Each member state of the European Union (EU) goes through a certain period of time, which is conventionally called pre-accession. This is the time during which it must prepare for its real membership in the union, build its

policies, arrange its administration according to the conditions and requirements set by the EU and the EC. According to Gorcheva (2016) [7], every country goes through a so-called pre-accession period, during which the economy, and in particular the agricultural sector, must build structures to implement the rules of the EU CAP.

The pre-accession period for Bulgaria is from 2000 to 2006, when it joined the EU membership queue together with nine other countries (Hungary, Poland, Czech Republic, Slovakia, Slovenia, Estonia, Lithuania, Latvia and Romania).

In July 1997, the European Commission presented a plan with a proposal for the reform of the CAP. In 1999, after negotiations, this "Plan 2000" was adopted. It also adopts a new enlargement strategy, which provides financial financing with the introduction of two new instruments - ISPA (Instrument for Structural Policies for Pre-Accession) and SAPARD.

The beginning of the pre-accession period is not at all easy, both for Bulgaria and for the agricultural sector in particular. In 2000, the country had not yet stabilized from the consequences of the economic crisis of 1996-1997. Nevertheless, the macroeconomic indicators of the country show growth and a growth trend is observed, characterized by the preservation of a level of economic stability (Table 1).

Table 1. GDP and GVA of Bulgaria for the period 2000-2006

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| GDP in million euros | 12,987 | 15,158 | 16,492 | 17,556 | 19,392 | 21,402 | 25,046 |
| GVA in million euros | 11,496 | 13,369 | 14,538 | 15,352 | 16,807 | 18,379 | 20,394 |

Source: own database development from Agrarian reports [1].

During the pre-accession period, the decreased economic indicators of the country and the growth of employment, respectively the reduction of the amount of unemployment, are noted. While the share of the agricultural sector in the GDP is also gradually decreasing. At the end it reached 50% lower values than the beginning of the pre-accession period (Figure 1). We follow this trend in the affairs of the Agricultural sector in the BDS of the country (Table 2). The development of the sector is in complete contrast to the state support during this period, where there is a gradual increase in the funds that the State Fund "Agriculture" provides to help farmers. (Ganev, 2009) [6].

A major drawback in the provision of funds by the state is their incorrect distribution among beneficiaries. A large part of the subsidies is provided to a minimal part of farmers - the larger ones, and the remaining funds, about 20% of all support, are distributed to small and medium-sized producers, which are 93% of those who applied for support. This shows that subsidies are not the correct and correct measure to support the Agricultural sector, due to the incorrect direction and distribution of funds.

Other factors that adversely affect the sector and its economic development during this period are fragmented ownership of agricultural land, difficult access to credit for farmers, low investment activity, and others.

According to data from the indicative distribution of SAPARD, Bulgaria is in third place in terms of the amount received after Romania and Poland. The designated support for our country is in the amount of EUR 52.124 million per year for the entire period.

A basic principle of the structural funds is co-financing. EU support does not replace national aid, it is a supplement to the countries' efforts to support a specific sector or region - 75% is aid from the EU and 25% is national co-financing from the state budget.

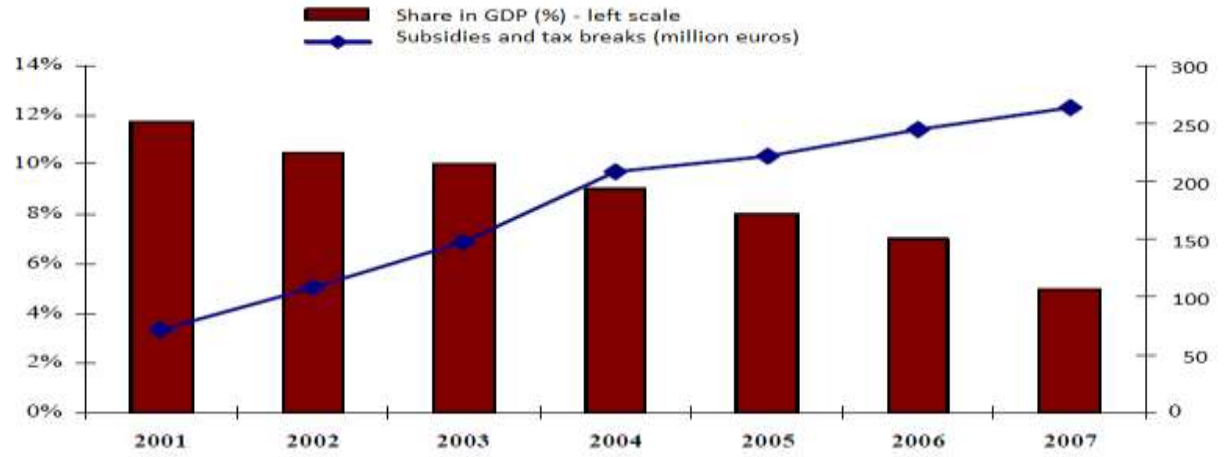


Fig. 1. Share of the agricultural sector in the country's GDP, 2001-2007
Source: Agrarian reports of the Ministry of Agriculture, Reports on the implementation of the budget of the MoF [1].

Table 2. Relative share of BDS created in the Agricultural sector for the period 2001-2006, %

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|
| GVA | 13,4 | 12,1 | 11,4 | 10,9 | 9,3 | 8,6 | 6,2 |

Source: own development with data from Agrarian reports [1].

During the pre-accession period, farmers received strong support from Europe, which manifested itself through subsidies under various schemes and measures.

At the end of 2009, payments to Bulgaria, including advance payments, amounted to EUR 327.6 million (88.2% of the final amount allocated under the program). The implementation rate is 73.6% compared to the initially determined 444.7 million Euros. At the end of SAPARD, 3,509 projects were agreed with a subsidy in the amount of 703,219,676.98 euros. All projects are 2,600, they were correctly implemented and were paid with a subsidy in the amount of 448,133,669.54 euros.

In the implementation of SAPARD, Bulgaria is faced with several main challenges, such as: established abuses of European funds; conflicts of interest between drafters, examiners and approvers; the frequent change of management and team of the SAPARD Agency, and non-transparency in their work. Projects under measure 1.2 have been discontinued. Improvements in the processing and marketing of agricultural and fishery products in March 2008 and sanctions imposed until investigations into aid fraud cases are completed. After some time (3 months), the financing under measure 1.1 was also terminated. Investments in agricultural holdings and 2.1. Development and diversification of economic activities and creation of opportunities for multifaceted activities and alternative incomes.

With SAPARD, agriculture was given the opportunity to develop and receive financial support in the form of the implementation of investment projects aimed at the needs of the specific agricultural holding.

***First program period of the CAP in the EU 2007-2013***

The CAP is one of the oldest policies of the European Union. Over the years, it has undergone several reforms, the most important of which was the one in 1992, relatively retaining its effect to this day. It is characterized by qualitative changes in regulation mechanisms and market orientation. It mainly concerns the increase of competitiveness and diversification of agricultural production, the achievement of stabilization of the European markets of agricultural production, the protection of the environment and the limitation of excess budget expenditures by limiting export subsidies.

Until 1992, subsidies were granted for the amount of agricultural production produced, and after the reform - direct subsidies or payments to farmers, without them being tied to production, i.e. the degree of financial support to member states is reduced.

The total budget of the RDP for the period 2007-2013 is in the amount of BGN 6,341 million (EUR 3,242 million), of which BGN 5,089 million (EUR 2,602 million) is from the EU, and 1,236 BGN million (EUR 632 million) - from the state budget.

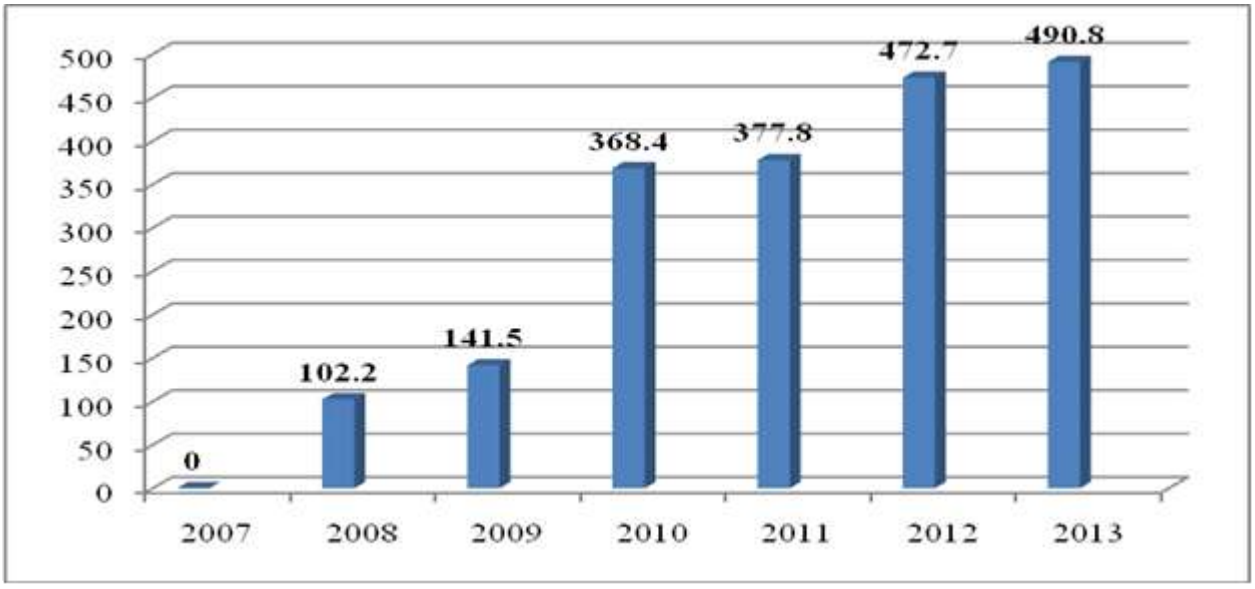


Fig. 2. RDP payments for the period 2007-2013, Euro Million
Source: own database development from RDP payments.

Figure 2 shows the positive trend of payments made. The initially approved budget of the RDP for the period 2007-2013, according to the EU, is 2,642,248,596 billion euros, or 94% absorption of the program. The RDP budget, 2007-2013, after the 16th amendment on the EU line is 2,500,837,171 billion euros or 99% absorption of the program.

The program for the development of rural areas for the period 2007 - 2013 has much more financial resources compared to SAPARD. During this period, an increase in the area with cereal crops was observed, the competitiveness of the sector improved. This is due to the applied mechanisms of the agrarian market, based on the intervention of the State fund "Agriculture" regarding cereals. Payments under the Single Area Payment Scheme (SAPS) help farms cover their working capital needs for input inputs (Harizanova-Bartos, 2018) [8].

During the period, a number of problems were identified related to the unfavorable direction of utilization of the funds, its effectiveness in relation to the farmers (beneficiaries), as well as in relation to its general impact on agriculture in the country: Uneven absorption of subsidies according to the various measures; The impossibility of farmers to realize their projects; Delay in processing submitted applications; Project delays or non-implementation; There is a lack of feedback to the candidates on the various measures.

***Second programming period of the CAP in the EU, 2014-2020***

The implementation of the RDP in the second program period is according to Regulation No. 1305/2013. Three months after the adoption of the RDP with a decision by the EC approving the program, a Monitoring Committee for the RDP 2014-2020 was established. According to the RDP, the goal is to monitor the effective and qualitative implementation of the program through the given financial and performance indicators.

The total budget of the RDP for the period 2014-2020 is EUR 2,896.15 million, including the contribution from the European Agricultural Fund for Rural Development in the amount of EUR 2,366.72 million and

national co-financing – EUR 529.43 million. euro (Figure 3).

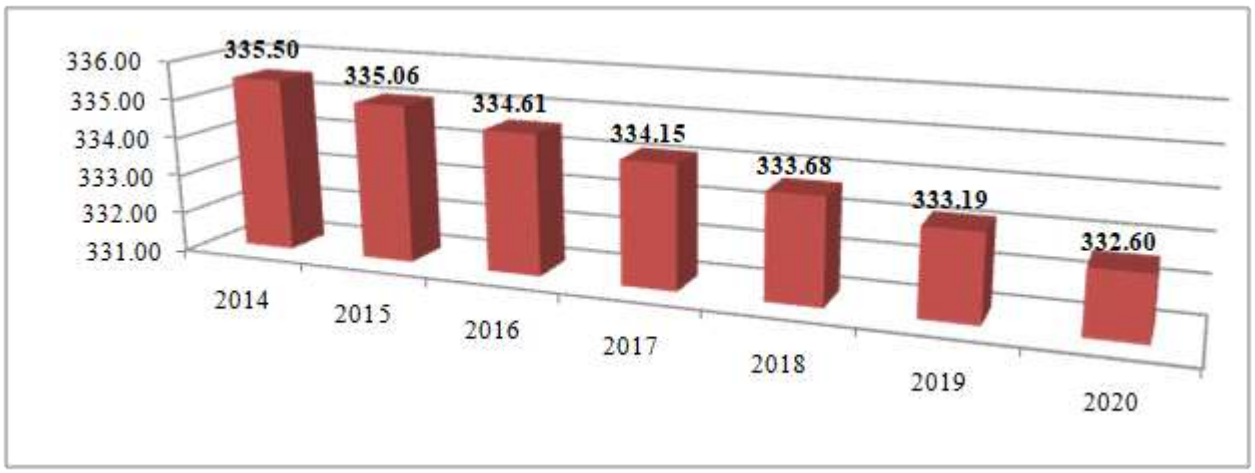


Fig. 3. RDP payments for the period 2014-2020, EUR million
Source: own database development from RDP payments.

Compared to the previous programming period, the 2014-2020 RDP shows progress in several directions. The control during the verification of project proposals has been strengthened, which limits the misuse of European money. At the same time, the sequence of opening the measures is logical, as the receptions for the "big" measures - 4.1 for agricultural holdings and 4.2 for the processing industry are opened first, in order to leave enough time for their implementation until the end of the period. However, these advantages remain in the background in the presence of the aforementioned complications, which can be arranged as follows:

- The delay and the difficulty of the process of creating regulations, created by the lack of coordination between the State fund "Agriculture", the Ministry of Agriculture and the non-governmental organizations;
- The difficult preparation of projects by the beneficiaries, imposed by the unclear interpretation and imposed changes at the last moment of the eligibility criteria;
-Prioritization of grain producers over producers in sensitive sectors, which contradicts the objectives of the program;
- The great delay of sub-measure 6.4 "Investments in non-agricultural activities" and the uncertainty surrounding the possibility of financing the so-called "Guest House".

***Third program period of the CAP in the EU 2021-2027***

Compared to 2020, there is a growth (32.9%) of labour productivity in the "Agriculture" sector. Eurostat data for 2021 show that Bulgaria leads on this indicator within the EU-27, with the average productivity growth in the sector for the EU being 1.5%.The analysis of the distribution of support among the beneficiaries in Bulgaria for the period 2007-2017 shows the accumulation of significant funds from large economic structures and a smaller amount of support for small farms.

The concentration coefficient of the unevenly distributed amount, which takes into account only the subsidies that are not evenly distributed among the beneficiaries, shows that for the period 2008-2013, 75-76% of the subsidies were unevenly distributed. For the period 2014-2020, there is a positive change of decrease in the level of the coefficient (to 0.64 for 2017), which is due to the measures within the framework of CAP implementation for more balanced support by farm types.

Aggregated data of the State Fund "Agriculture" indicate that 51% is the total utilization rate for all measures of the 2014-2020 RDP against the total budget of the Program (3,069,678,00 euros, European Agricultural Fund for Rural Development).

Table 3. RDP payments for the period 2021-2027 (million euros)

| Funding Period | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 21-27 |
|---|---|---|---|---|---|---|---|---|
| Payments, EUR million | 344,602 | 282,199 | 282,200 | 282,200 | 282,200 | 282,199 | 282,200 | 2,037,602 |

Source: own database development from RDP payments.

In the third program period, new measures and sub-measures have been introduced, which are in response to crisis situations that have arisen for the Agricultural sector. Such is measure 21.

Extraordinary temporary support for farmers and SMEs, which are particularly affected by the crisis caused by COVID-19.

It is a financial instrument with which to respond adequately to those particularly affected by the crisis caused by COVID-19".

With Ordinance No. 2 of August 5, 2020 for the implementation of measure 21 of the program for the development of rural areas for the period 2014 - 2020, this measure was regulated for its implementation. The initiator of the introduction of this measure is Bulgaria.

In Ukraine, the financial aid under the emergency measure due to the war, which the "Crop farming" sector receives, is BGN 222 million.

These changes were imposed regarding the implementation of emergency temporary aid from the European Agricultural Fund for the Development of Rural Areas based on the consequences of the war.

The focus of the Strategic Plan for the Development of Agriculture and Rural Areas in Bulgaria (2021-2027) is on the sustainable development of agriculture and aims to improve incomes in the sector. Attention to innovation and the dissemination of scientific and innovative solutions, including digital ones, in agriculture and rural areas has been increased.

Funding is needed in the Agriculture sector. The majority of farmers' financial needs are met from own funds (deposits or own savings or CAP payments) rather than loans. The demand for finance is mainly due to the need for working capital, investment in modernization and purchase of land.

## CONCLUSIONS

With the accession to the EU, after 2007, Bulgaria's agricultural sector began to receive financial support from the European Union for the first time in the form of free subsidies under various schemes and measures.

During the first program period (2007-2014), uneven absorption of European subsidies was found. An imbalance in favor of large enterprises was reported, with small ones being disadvantaged. An increase of nearly 380% in European aid for the Agricultural sector was found. The RDP budget in the second program period is EUR 2,500,837,171 billion, with a 99% implementation rate.

In the second programming period (2014-2020), a slight decrease in European funds (0.86%) was registered, but an increased interest on the part of agricultural producers was found. Agrostatistics data of the State Fund "Agriculture" indicate that only 51% is the total absorption rate for all measures of the RDP 2014-2020 compared to the total budget of the Program (3,069,678,00 euros).

The analyzes showed some weaknesses reported during the periods:

Bulgarian farm liabilities are growing faster than assets as farmers use more loans than savings to cover their financial needs.

Small farms (under 20 ha) face the most difficulties in obtaining financing. They are more likely to be rejected or discouraged from applying for funding.

The unsatisfied demand for agricultural finance is mainly due to the following issues:

- Banks perceive the sector as high-risk and are reluctant to lend to farmers;
- Farmers are demotivated to apply for financing due to the lack of transparency in the banks' credit policy (banks can unilaterally change the conditions);
- The high collateral requirements imposed by the banks, the lack of suitable assets of the

agricultural producers, which are required as collateral;
- Lack of credit and accounting history of agricultural producers; lack of financial literacy on the part of farmers and their absolute inexperience in presenting business plans, etc.

## ACKNOWLEDGEMENTS

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# GREENING POLICIES FOR THE AGRICULTURAL SECTOR OF THE REPUBLIC OF MOLDOVA: CURRENT SITUATION AND FUTURE PERSPECTIVES

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***Abstract***

*Agricultural sector of the Republic of Moldova is currently facing a series of challenges, an important part of them being related to the greening of the sector. The existing public support schemes for greening agriculture are more related to mitigation of the climate change effects, with less focus on preserving the environment, and their share in the total public support is relatively low. The paper aims to analyze the existing public support schemes related to climate change adaptation and greening of sector and provide a series of recommendations for their improvement. In order to achieve the main aim of the paper, the following scientific methods have been used: generalization of empirical and applied material, induction and deduction methods for making the paper conclusions, comparison method and analytical one. In order to be in line with current greening EU policies, Republic of Moldova must adapt some of its public support schemes for the agricultural sector and pay more attention to development of a coordinative mechanism and advice services.*

***Key words*****:** *agriculture, greening, policies, public support*

## INTRODUCTION

Republic of Moldova is highly vulnerable to climate variability and change (Taranu, 2014) [13]. Climate change has a significant influence not only on the environment, but also on the economy, as a whole, and the agricultural sector, in particular. Having a share of over 10% in GDP, about 21% of active population being employed in the agricultural sector and over 57% of people living in rural areas, agriculture is of particular importance for the national economy. More than 45% of Moldovan exports are of agri-food origin; transport sector is also strongly connected with agriculture, as well as food processing industry. This means that climate change could have particularly severe effects on the livelihood of people in rural areas because of their greater dependence on agriculture, their more limited ability to adapt, and the high share of income they spend on food. Climate impacts could therefore adversely affect food security and economic growth in vulnerable rural areas and undermine the progress that has been made in poverty reduction (FAO, 2020) [7].Therefore, the socio-economic costs of climate related natural disasters such as droughts, floods and hail are significant and both their intensity and frequency are expected to further increase as a result of climate change (Taranu, 2014) [13].

Although being located between two large rivers, agriculture of the Republic of Moldova faces important shortages of water in years with small number of precipitations. On the whole, Moldova is located in an area with quite limited water resources, which results in a high frequency of droughts. For example, from 1990 to 2010 the country has undergone nine droughts, and the most serious one in 2007, and two major floods in 2008 and 2010 (Ivanov, 2012) [10].The most recent droughts that have occurred in 2020 and 2022, have recorded significant reductions in crop production. Increasingly frequent droughts mean agriculture requires higher volumes of

water and irrigation. This water is often delivered through inefficient systems, leading to large losses. Thus, besides a high volume of water intake per capita and a relatively high level of water stress, Moldova still experiences significant water losses due to transportation with no sign of improvement (EU4Environment, 2021) [5]. In the same vein, some of the most direct consequences of climate change to agricultural sector include water scarcity and issues related to e.g. water supply, reduction of animal feed, lowering agriculture outputs, crop and animal diseases and forest degradation (FAO, 2020) [7].

Being accepted as a Candidate country in the EU in 2022, Moldova will be necessary complying with a series of EU policies, most important for the agricultural sector being the Common Agricultural Policy. Greening of this sector represents a priority in the new CAP, some of the objectives being related to promotion of sustainable energy, taking appropriate measures for climate change mitigation and adaptation, enhancing the efficient administration of natural resources and their durable development, preservation and improvement of ecosystems, etc. (European Commission, 2023) [6].

Therefore, it is becoming very important to align the agricultural policies to CAP and to observe which of the current support measures are contributing to greening of the sector and its further development.

The aim of the paper is to provide an outlook to the current state of the green policies for the agricultural sector of Moldova and analyze some future perspectives for their development.

## MATERIALS AND METHODS

In order to achieve the main aim of the paper, the following scientific methods have been used: generalization of empirical and applied material, induction and deduction methods for making the paper conclusions, comparison method and analytical one.

The main data used for the analysis is based on annual reports of the Agency for Interventions and Payments in Agriculture [1]. The analysis carried out covers the period 2010 – 2022.

## RESULTS AND DISCUSSIONS

In order to adapt to the climate change phenomenon, the Moldovan policy makers have introduced in the subsidy program a series of schemes or measures to support the agricultural producers in this regard. The direct measures targeting adaptation and mitigation of the climate changes events are the following ones: Sub-measure 1.1. Stimulating investments for the production of vegetables and fruits on protected land (winter greenhouses, solariums, tunnels), Sub-measure 2.2. Stimulating investments for the procurement of irrigation equipment, Sub-measure 2.3 Stimulating agricultural producers to compensate the irrigation expenses, Sub-measure 2.4 Stimulating investments for the procurement of no-till and mini-till equipment and Sub-measure 2.5. Supporting the promotion and development of organic agriculture.

In 2022, 1,750 mil. MDL have been allocated in order to support the agricultural sector of the Republic of Moldova. This sum represents the highest figure in the history of subsidies allocations, as in previous years, the amount has varied from 900 mil. MDL in 2018 to 1535 mil. MDL in 2021. The highest share of allocated subsides are post-investments ones, meaning that the investment has to be made by farmer, first, and afterwards apply for compensation of costs. Therefore, the post-investments subsidies are mostly accessible for agricultural producers that poses sufficient financial means or access to credit markets (Herzfeld et al, 2022) [9].

The Ministry of Agriculture and Food Industry, the main policy maker in the field of agriculture is currently supporting, through the Agency for Interventions and Payments in Agriculture, agricultural producers that intend to green their activity and make it more adaptable to climate adverse phenomena. Therefore, investment support for the Sub-measures 1.1., 2.2, 2.3, 2.4 and 2.5 during 2010 – 2022 has amounted to 950.8 mil.

MDL, accounting, on average, for about 8.9% of the total value of the National Fund for the Development of Agriculture and the Rural Environment (subsidy fund). The total value of the Fund has been continuously increasing since 2010, reaching a maximum value of 1750 mil. MDL in 2022, which means an increase of about 4.3 times compared to 2010.

In the same vein, allocations for environmental activities have increased from 14.6 mil. MDL in 2010 to 164.9 mil. MDL in 2022. In 2022, the amount of 164.9 mil. MDL represents the maximum value of allocations for environmental activities from the analyzed period, thus, pointing on the increasing interest from famers with respect to greening agriculture, as well as on the awareness of policy makers on the importance of climate change adaptation and mitigation support measures.

The share of the support for environmental activities in the total support for the sector, from the Fund, varies from 3.7% in 2010 to 9.4% in 2022, the maximum value being reached in 2018 – 13.4%, while the minimum – in 2011 – 1.6%.

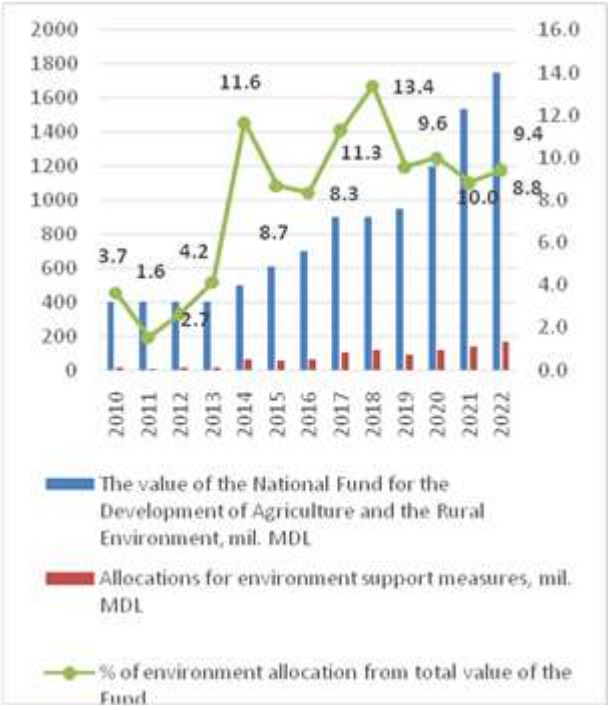


Fig. 1. Budget support for environmental actions, 2010 – 2022, mil. MDL

Source: Agency for Intervention and Payments in Agriculture, 2010 - 2022 [1].

Vegetables are being consider an important crop for Moldovan agricultural sector. Greenhouses for vegetable production require technological improvement (Petrea et al, 2020) [11]. Therefore, with respect to Sub-measure 1.1. Stimulating investments for the production of vegetables and fruits on protected land (winter greenhouses, solariums, tunnels), the support is granted for partial compensation of the cost of new modules for greenhouses, solariums, tunnels purchased starting with two previous subsidy years and put into operation in the subsidy year. The minimum area eligible under this sub-measure is at least 0.1 ha (Guvernul Republicii Moldova, 2017) [8]. During 2010 – 2022, a total of 1,328 applications have been authorized for funding and the amount of authorized subsidies accounted for 197.3 mil. MDL. This figure has been fluctuating over the years, with a growing trend during 2012 – 2014. At the same time, the total number of subsidized greenhouses amounted to 883, 147 solariums and 100 tunnels. The share of sub-measure 1.1 in the total value of Fund amounted to 0.7% in 2022, while in the total environmental support schemes – 7.7%.

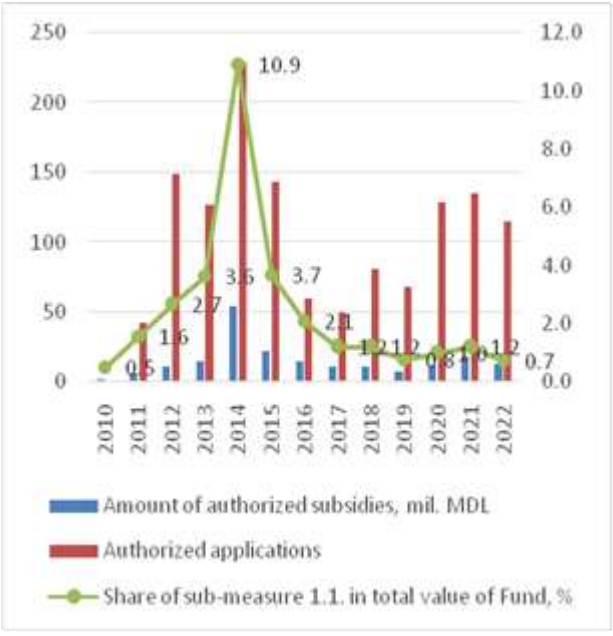


Fig. 2. Budget support under Sub-measure 1.1, 2010 – 2022

Source: Agency for Intervention and Payments in Agriculture, 2010 - 2022 [1].

In the Republic of Moldova, productivity crop plants is largely determined by the pedologic and climatic conditions. During the vegetation period of plants, especially in the months from June to August, virtually every year there are droughts of soil and air. In such climatic conditions, irrigation is a radical measure to optimize water regime of the soil and of crop plants (Cojocaru et al, 2017) [3]. Thus, under Sub-measure 2.2 Stimulating investments for the procurement of irrigation equipment, the amount of the support is calculated in the form of compensation for the new equipment, purchased starting two years prior to the subsidy, put into operation in the subsidy year, in proportion to:50% of the cost of new drip/micro sprinkler irrigation systems, but no more than 1.0 mil. MDL per beneficiary;40% of the cost of the sprinkler irrigation system, mobile irrigation systems, but no more than 800.0 thousand MDL per beneficiary;50% of the cost of the pumping station, fertigation station, geomembrane, geotextile for water capture, but no more than 1.0 mil. MDL per beneficiary;50% of the cost of the equipment that forms the supply and/or distribution networks, but not more than 2.5 mil. MDL per beneficiary;50% of the cost of the irrigation water treatment system, by various methods, including reverse osmosis, but no more than 2.0 mil. MDL per beneficiary (Guvernul Republicii Moldova, 2017) [8].The given support measure was implemented first in 2015. During 2015 – 2022, the total amount of allocated subsidies accounted for 357.04 mil. MDL, with 2013 applications. The share of sub-measure 2.2 in the total value of Fund amounted to 4.2% in 2022, while in the total environmental support schemes – 44.6%. The area under irrigation in 2022 was 7,812 ha. The total number of drip irrigation equipment in the analyzed period was 1549 units, sprinkler irrigation equipment – 274 units, 52 fertigation stations, geomembrane, and 68 supply and/or distribution networks.

Under Sub-measure 2.3 Stimulating agricultural producers to compensate the irrigation expenses, the subsidy is granted to agricultural producers, including through water user associations, for the partial compensation of the expenses incurred when pumping/repumping water for irrigation.

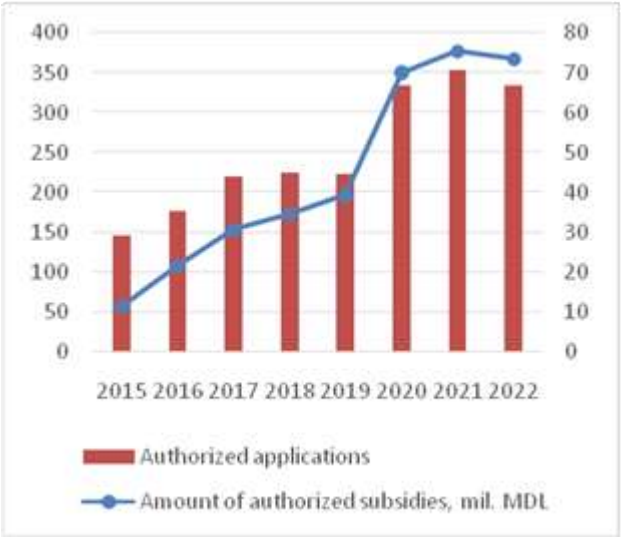


Fig. 3. Budget support under Sub-measure 2.2, 2015 – 2022

Source: Agency for Intervention and Payments in Agriculture, 2010 - 2022 [1].

It is also worth mentioning that the applicants must demonstrate, through a reporting form, that they have obtained an increase in production yield on irrigated land, with the exception of young perennial plantations and agricultural crops intended for seed production (Guvernul Republicii Moldova, 2017) [8]. Thus, during 2013 – 2022, the total amount of allocated subsidies accounted for 49.9 mil. MDL, with 335 applications. The share of sub-measure 2.3 in the total value of Fund amounted to 0.8% in 2022, while in the total environmental support schemes – 8.2%. The irrigated surface in 2022 was about 2380 ha.

Conservation agriculture is widely promoted as a sustainable agricultural management strategy with the potential to alleviate some of the adverse effects of modern, industrial agriculture such as large-scale soil erosion, nutrient leaching and overexploitation of water resources. Moreover, agricultural land managed under CA is proposed to contribute to climate change mitigation and adaptation through reduced emission of greenhouse gases, increased solar radiation reflection, and the sustainable use of soil and water resources (Prestele et al, 2018) [12].

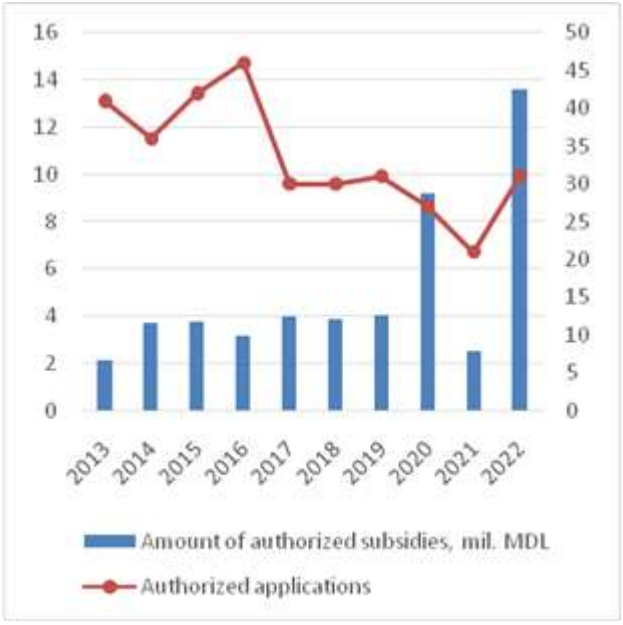


Fig. 4. Budget support under Sub-measure 2.3, 2015 – 2022
Source: Agency for Intervention and Payments in Agriculture, 2010 - 2022 [1].

In the Republic of Moldova, it is practiced on an area of over 50 thousand hectares, mainly in the Northern area of the republic (Cojocaru, 2021) [4].

The Sub-measure 2.4 Stimulating investments for the procurement of no-till and mini-till equipment, aims to enhance the conservation of agriculture. The public support allocated to farmers takes the shape of compensation of 30% of the costs of the investment object, with a maximum available amount of 50o thousand MDL for one beneficiary that has purchased new no-till or mini-till equipment (Guvernul Republicii Moldova, 2017) [8]. Since 2015, the total amount of allocated subsidies accounted for 316.6 mil. MDL, with 1734 applications. The share of sub-measure 2.4 in the total value of Fund amounted to 3.7% in 2022, while in the total environmental support schemes – 39.5%. The total number of purchased equipment accounted for 2091 units. The surface processed with no-till and mini-till equipment in 2022 was about 58,422.5 ha.

Under Sub-measure 2.5. Supporting the promotion and development of organic agriculture, support is granted to producers who are registered in the organic farming system as a compensatory payment for the loss of income and the additional costs incurred by the beneficiaries who conclude voluntary commitments and undertake to stay in this farming system for a period of 5 years.

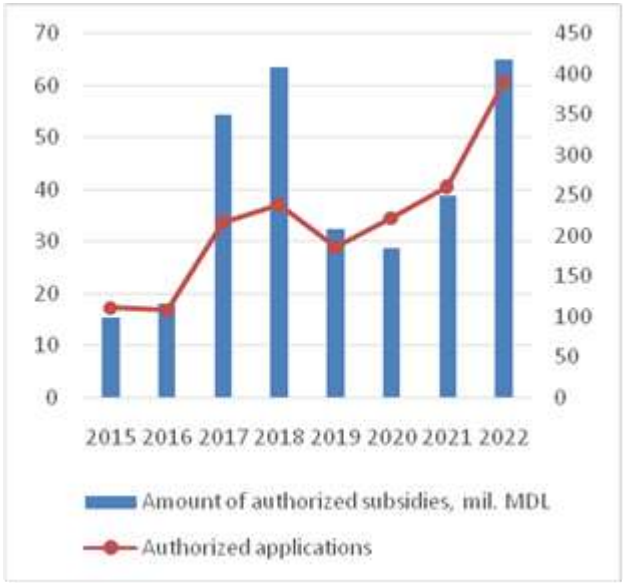


Fig. 5. Budget support under Sub-measure 2.4, 2015 – 2022
Source: Agency for Intervention and Payments in Agriculture, 2010 - 2022 [1].

Republic of Moldova has ones of the most suitable climate conditions for the development of organic agriculture. It is worth noticing that the importance of organic farming has been increasing in the last years. If in 2010, about 19.7 thousand ha of agricultural land were under organic farming, then in 2020 their share accounts for about 1.5% of the total agricultural land of the country (Cimpoies, Cosalic, 2022) [2].

Beneficiaries of the subsidy have to return the received support funds if they do not maintain themselves in the organic farming system for 5 years (Guvernul Republicii Moldova, 2017) [8]. The public support under this sub-measure began to be allocated in 2016. During 2016 – 2022, the total amount of allocated subsidies accounted for 38.6 mil. MDL, with 353 applications. The share of sub-measure 2.5 in the total value of Fund amounted to 0.4% in 2022, while in the total environmental support schemes – 4.2%. The surface intended

for organic agriculture under the call of applications in 2022 was about 353.7 ha.

Table 1. Budget support under Sub-measure 2.5, 2015 – 2022

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|
| Amount of authorized subsidies, mil. MDL | 0.6 | 1.59 | 7.25 | 7.85 | 6.9 | 7.5 | 6.9 |
| Authorizedapplications | 12 | 30 | 69 | 67 | 65 | 59 | 51 |
| Surface, ha | 443 | 1,439 | 3,023 | 2,538.4 | 2,538.4 | 720.4 | 353.7 |

Source: Agency for Intervention and Payments in Agriculture, 2010 - 2022 [1].

Therefore, the existing of environmental actions support schemes and applications by agricultural producers prove the concern of farmers for mitigation of the climate change effects and introducing of good agricultural practices related to soil preservation, water management, etc.

The steps undertaken in relation to coping with climate change are concerning the following aspects:

-Applying protective measures such as moving vegetable production to greenhouses, including winter green houses, tunnels and solariums, using mulch or other plant protection on soil, installing plant protection belts, and using hail nets (sub-measure 1.1);

-Expanding water supply for irrigation by building small-scale storage reservoirs, harvesting rainwater, and making greater use of local water sources for irrigation, such as creeks and groundwater as well as introducing drip irrigation and sprinkler irrigation systems (sub-measures 2.2 and 2.3).

-Changing agronomic practices, such as using no till techniques, converting to organic production, planting patterns, crop rotation and inter-cropping, chemical soil augmentation, using drought-resistant varieties (sub-measures 2.4 and 2.5) (FAO, 2020) [7].

Moreover, in the light of the most recent climate events like hail or severe droughts from 2020 and 2022 it is very important for the agricultural policy promoted by public authorities to focus on enhancing the possibility of agricultural producers to face the climate risks through well-thought risk management policies.

This policy field yields high synergies with farm extension service. But as weather events might have strong impacts at a regional scale, i.e. several neighboring farms will be affected at the same time, risk management cannot be exclusively delegated to farm managers. Instruments to secure the liquidity of farms might be necessary in addition (Herzfeld et al, 2022) [9].

## CONCLUSIONS

Greening of the agricultural sector of Moldova is in continuous evolution. Public support for environmental schemes has increased in the recent years, thus demonstrating the interest of both, policy makers and agricultural producers in this topic. Taking into account that agricultural sector is already passing through important impacts of climate change, adaptation policies might receive a priority, compared to mitigation ones.

Therefore, a series of recommendations are provided for increasing the level of public support in environmental activities. First of all, in order to be in line with current greening EU policies, Republic of Moldova must adapt some of its public support schemes for the agricultural sector and pay more attention to development of a coordinative mechanism and advisory services.

Organic agriculture represents one of the most important directions, when speaking about greening of the sector. The development of organic farming will lead to an increase in the number of agricultural producers engaged in organic sector and, therefore, greening of the Moldovan agriculture. Moreover, the maximum amounts of allocated subsidies for organic agriculture, per request, could be eliminated in order to support the involvement of farmers in this sector. All of these will contribute to a better development of farms,

so that they can handle the existing and potential economic and environmental challenges, as well as ensure sustainable development and increase the competitiveness of the sector.

Another direction might be support for farmer's adaptation, by encouraging the selection of new types of crops and / or seed varieties resistant to drought / arid periods through support programs and improved access to seedling material/using good agriculture practices to reduce impact of harsh climatic conditions and protecting forests. Improved heat-tolerant varieties or new crops with the same qualities allow the plant to maintain yields at higher temperatures, specific in some years to the Republic of Moldova. Heat tolerant varieties could help increase crop yields.

Besides the existing support measures on compensation of costs for purchase of no-till and mini-till agricultural machinery, additional actions are needed to eliminate the consequences of soil degradation and restoration of productivity levels like increasing the areas with cover crops in gardens and perennial plantations, use of soil-friendly agricultural practices, application of crop rotation patterns and provision of additional incentives for an environmentally friendly land management.

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# THE INTERCONNECTION MODEL BETWEEN THE REPUBLIC OF MOLDOVA'S FOOD SECURITY AND ITS AGRICULTURAL PRODUCTS EXPORT

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***Abstract***

*The main objective of this study is to analyze the food security resilience of the Republic of Moldova. For this reason, it is essential to establish the interconnections between food security and foreign trade of the Republic of Moldova in the actual circumstances on the external market. On the one hand, agricultural economic agents faced the loss of traditional export markets. The most vulnerable category in this regard is 08. Edible fruits and nuts; peels of citrus fruits or melons, which in 2021 constituted 7.40% of the total exports. About 52.15% of the export of this category was directed in 2021 in Russian Federation. On the other hand, the increase in the prices of agri-food products has intensified the risks of excessive growth of exports and their potential insufficiency for consumption on the domestic market. In conclusion, it is highlighted that the situation in the region of our country generates vulnerabilities with a substantial impact on food security.*

***Key words*****:** *food security, agricultural products, agriculture, export, trading partners.*

## INTRODUCTION

The changes made under the influence of global crises have repercussions on strengthening the resilience of food security and, therefore, on the export potential of essential agri-food products.

For the Republic of Moldova, agri-food products are the main exported commodities and represent about 45% in total amount of exported merchandises which reflects the importance of agriculture in the economy (Cimpoies and Coser, 2018) [3].

Export is one of the determinants of the country economic growth, assuring jobs and income in agriculture and food industry, and balancing the payment balance (Litvin and Diaconu, 2018) [4].

That is why in this paper, we considered to be important to analyze Moldova's agri-food sector, and also the influence that the COVID-19 pandemic and the hostilities in the region have had on the agricultural sector and agrifood export.

The core of this research work is the analysis of the interconnection between food security resilience following the export potential of the main agri-food products.

Researching the interconnections between food security and foreign trade has been in the sight of scientists in the field for a long time. This stems, on the one hand, from the importance of agriculture in ensuring the vital functions of the population, and on the other hand, from the role of export as a source of income for countries and import as a means of covering food sufficiency.

Moreover, agriculture must also be treated from the cultural and philosophical dimension and its impact on ecology. In this context, according to *Jennifer Clapp*, it is necessary to accept the assertion that agriculture fulfills different roles in society. It is imperative to balance these objectives with efficient reflections in commercial policy (Clapp, 2015) [2].

In this study we refer strictly to food security, according to the Declaration of The World Summit on Food Security from Rome (1996). It represents "a situation where everyone has social access to sufficient, safe, nutritious food to maintain a healthy and active life".

The mention of "all times" gives this notion a feature of perspective.

Food security is a fundamental factor in developing a country's economy. The concept of food security is complex and multidimensional. The official definition adopted by the World Food Summit is the following: "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996) [6].

This definition was completed in 2001: "Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2002) [7].

The definitions show that the level of economic development determines national food security. This interdependence guarantees the stable supply of food products to the population, in the necessary quantity and according to scientifically determined norms, and the processing industry - in domestic raw agricultural materials. National agricultural production represents the basis for creating and maintaining food potential.

The development of domestic production of food products and raw agricultural materials creates confidence among the population in their sufficiency and is a way of managing risks that may arise in relations with exporting countries (harvest losses, import restrictions, price increases). The dimension of foreign trade, in the framework of food security, is a compelling aspect, both for exporting and importing countries. In both cases, foreign trade catalyzes economic development, guaranteeing increased income, demand, expansion of supply, and range of products. International trade revives production in those regions where conditions are optimal for it.

At the same time, foreign trade relations in the field of food supply solve problems such as the reliability of importing countries and the availability of an adequate level of foreign exchange resources. Importing countries consider food and raw materials strategic commodities that ensure societal stability.

Exporting countries can use their position for economic and political pressure.

In this vein, we must also mention the *Agreement on Agriculture* of the WTO (WTO, 1993) [17], in which the long-term objective is stipulated "to provide for substantial progressive reductions in agricultural support and protection sustained over an agreed period, resulting in correcting and preventing restrictions and distortions in world agricultural markets".

*Elisabetta Aurino* [1] outlines that there are two fundamental ways through which time can be projected in the food security analysis. The first method relates to the evaluation component (ex-post and ex-ante).

The second modality has another aspect, through which the manifestation of time is involved in analyzing food security, arising from periodicity, and can be either chronic or transitory, a manifestation which, therefore, must have consequences in elaborating economic policies.

In the belief of a considerable part of the academic community in the field, trade liberalization can improve the food security situation of developing countries and reduce their food disproportion.

In this regard, to *Michael Trueblood & Shahla Shapouri*, low-income countries should focus on three areas of foreign agricultural trade that impact import prices and export earnings: market access, domestic support, and export subsidies (Trueblood &Shapouri, 2001) [16].

The impact of COVID-19 on the resilience of food security has been placed on the agenda of researchers the increasing international cooperation in fields related to this topic.

Thus, *Carlos Kuriyama* concluded that food security and foreign trade are complex, essential compartments that require further analysis (Kuriyama, 2020) [11].

In addition, the Republic of Moldova has faced many vulnerabilities regarding agricultural production and its profitability cause by the price boom for farm inputs in the last years, drought, and hostilities in the

region with a deep negative impact on its foreign agri-food trade and on food security. One of the crucial problems, that the Republic of Moldova had to overcome, was the reorientation of exports of its agri-food products to other markets.

Because of the increase in the prices of stock market agri-food products, the risks of an excessive elevate in agri-food products exports and their potential insufficiency for consumption on the domestic market intensified.

The multidimensional nature of food security has yet to be thoroughly researched in concordance with assessing the export potential of essential agri-food products.

For the Republic of Moldova, which is a country with a small and open economy, the issue of food security resilience is an essential one.

Risk management, which is emerging in the future, outlines the need to estimate the export of agri-food products from the perspective of food security resilience.

Assessing the Moldovan agri-food products export will highlight its interference with food security, provide opportunities for good European practices and identify possible development areas.

## MATERIALS AND METHODS

The primary data sources are represented by trade data provided by the International Trade Centre and National Bureau of Statistics of the Republic of Moldova and general statistical data provided by the National Bureau of Statistics of the Republic of Moldova.

The present analysis is based on a mix of complex scientific methods: quantitative and qualitative. At the same time, during the research, the following strategies were used: case study and experiment.

## RESULTS AND DISCUSSIONS

The Republic of Moldova is a country where agriculture has not only an essential contribution to the formation of GDP (Fig. 1) but also a particular philosophical connotation in the culture and tradition of the people.

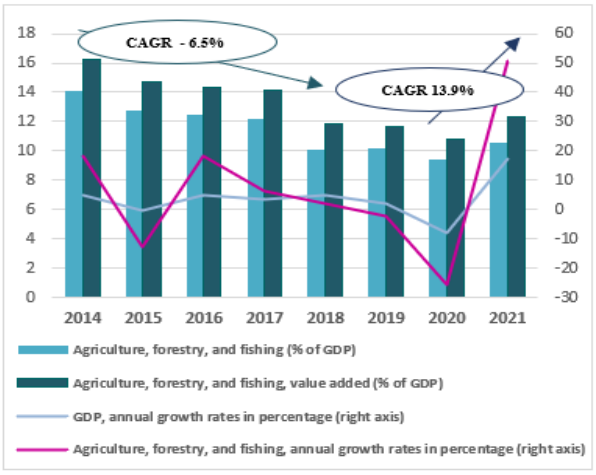


Fig. 1. The contribution of agriculture to Moldovan economic development, %
Source: (NBS, 2021) [12].

The CAGR indicator was applied to the contribution of agriculture, forestry, and fishing to the formation of gross added value, in order to highlight the role of agriculture in the economic development of the Republic of Moldova. Thus, in the last eight years, two periods have emerged. The first period is a long one (2014-2020), in which the participation of agriculture in the formation of added value decreased (CAGR -6.5%). In the second period (2020-2021), the CAGR increased by 13.9% (Fig. 1).

Agriculture, the most multifunctional branch of the national economy, includes vast fields of impact on society. Moreover, the functions of agriculture are more comprehensive than just food production for the population. Its contribution thus incorporates spheres such as food security; social stability; rural life; environmental services; rural landscapes; societal identity and cultural heritage, and agricultural products (Potter & Tilzey, 2007) [15].

In the present study, we will focus on the interdependence of food security of the Republic of Moldova and foreign trade in the actual context of the external market. Several composite indices are calculated to assess food security in international practice.

One of the most popular is the Global Food Security Index, which comprises four sub-

indices (affordability, availability, quality and bsafety, sustainability, and adaptation) and is calculated for 113 countries.

The Republic of Moldova, unfortunately, is not among these states (Economist Impact, 2022) [5]. Another approach is to determine food insecurity. One such important food security index is the Global Hunger Index, which measures hunger at the global level. In Fig. 2 it is shown the evolution of Global Hunger Index-GHI [9].

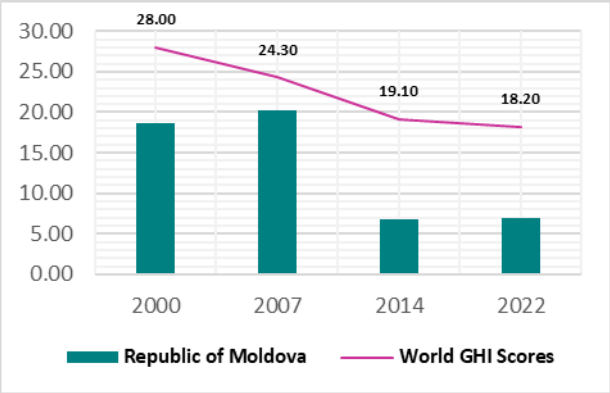


Fig. 2. The Global Hunger Index, 2000-2022
Source:(Global Hunger, 2022) [9].

The Republic of Moldova was ranked 32 out of 136 countries, scoring 6.9 points in 2022. If the score is lower than 9.9 – the hunger level is low, between 10-19.9 - moderate; between 20.0-34.9 - profound; more than 35 – is alarming (Global Hunger, 2022) [9].

Another set of indicators related to food security that have returned, from the shadows, in the studies of researchers during COVID-19 is food independence and self-satisfaction.

Therefore, in the first stage of analyzing the Republic of Moldova's food self-sufficiency the dynamics of foreign trade with agri-food products must be examined (Fig. 3).

Between 2014 and 2022, the evolution of exports and imports of agri-food products was distinctly manifested.

Thus, in the dynamics of exports, following the application of CAGR, four periods were highlighted (decrease (2014-2015, CAGR -14.2%; 2019-2020, CAGR -10.2%) and growth (2015-2019, CAGR 6.3%; 2021-2022, CAGR 33.4%)), while in the evolution of imports, there were two periods: one of decrease (2014-2015, CAGR – 18.5%;) and one of increase (2015-2022, CAGR 11.9%). The first period of decrease in foreign trade is due to the banking crisis in the Republic of Moldova and the sanctions imposed on the exports of Moldovan agri-food products by the Russian Federation. The second period of export decrease is a consequence of the COVID-19 pandemic (Fig. 3).

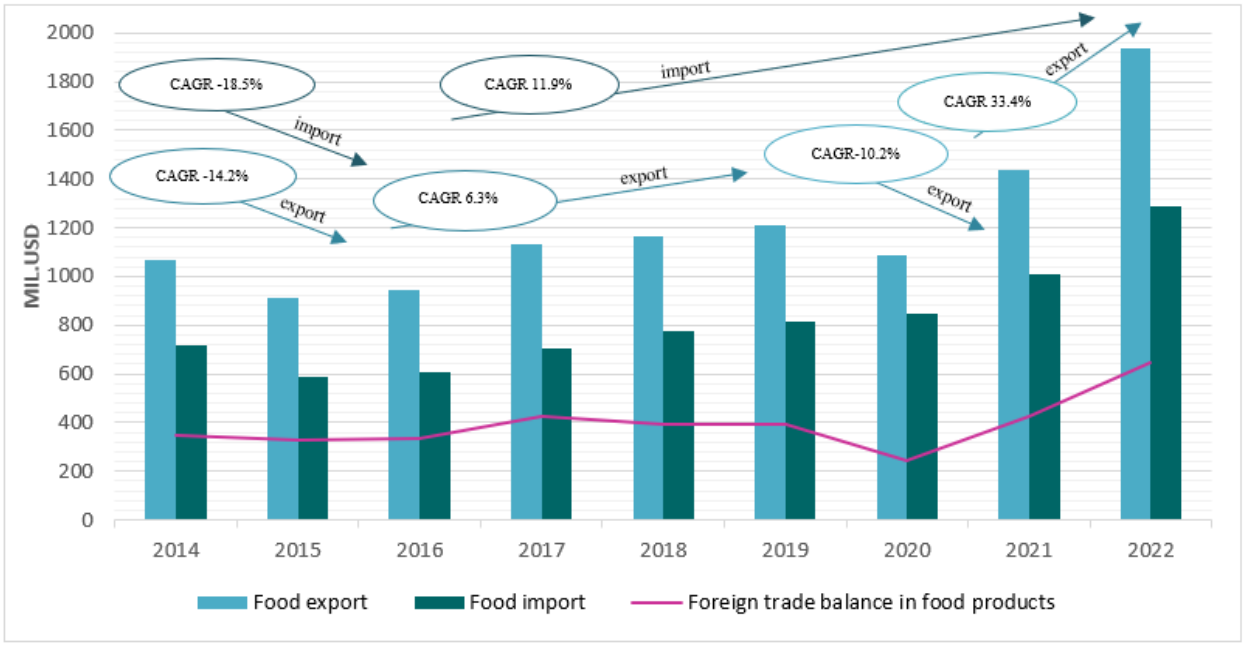


Fig. 3. Imports and exports dynamics of Moldovan agri-food products (USD million)
Source: National Bureau of Statistics, NBS, 2022a [13].

At the same time, we must mention that during the last eight years, the balance of foreign trade with agri-food products has been positive, although, in the last period, a tendency for its reduction can be observed.

As for the share of imports of agri-food products in total imports, it varied in the range of 13.44%-15.62% during the years 2014-2022 (Fig. 4).

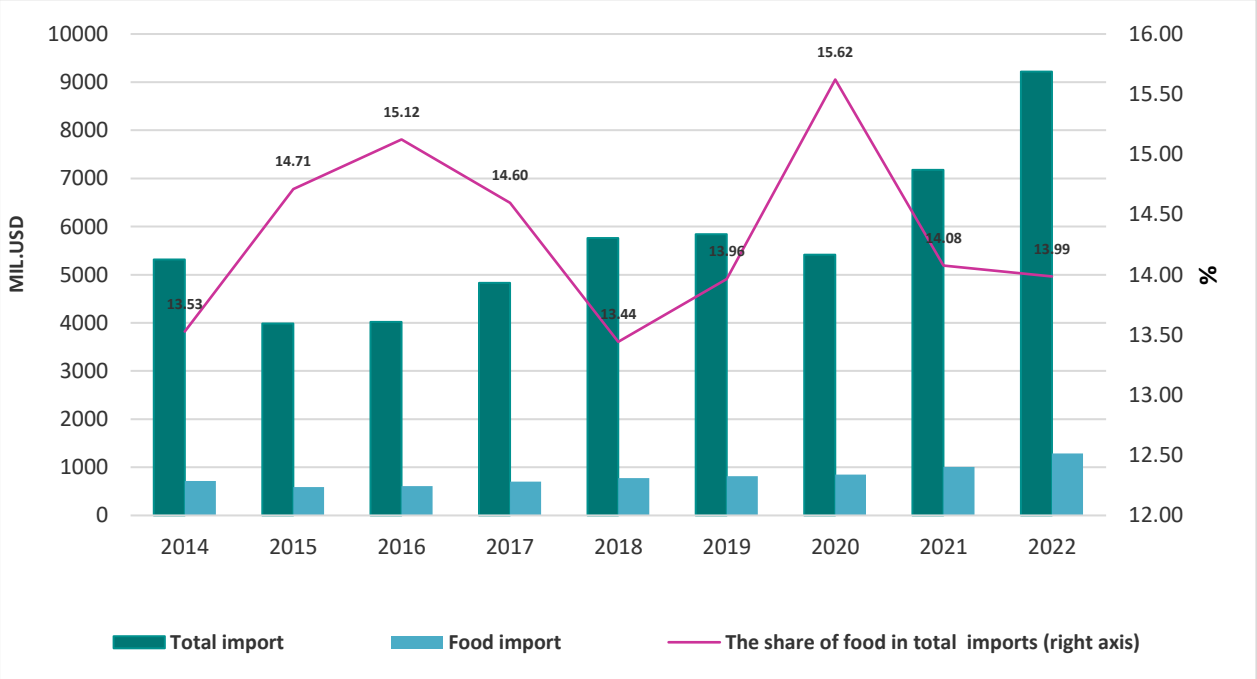


Fig. 4. The share agri-food imports in total imports, %
Source: (NBS, 2022, a) [13].

For a clearer vision, two indicators are calculated in international practice through which food independence and self-satisfaction can be assessed, namely SSR (Self-Sufficiency Ratio) and IDR (Import Dependency Ratio).

According to the FAO methodology (FAO, 2017) [8], these indicators are determined as follows:

$$SSR=\frac{FP}{FP+I-E}\times 100\% \quad \text{.....(1)}$$

where:

FP–Food Production;

I–Imports;

E–Exports.

$$IDR=\frac{I}{FP+I-E}\times 100\% \quad \text{.....(2)}$$

A higher IDR value indicates a greater dependence on agri-food product imports. While an SSR of more than 100 means more self-sufficiency. As a result of analyzing their evolution from 1997-2022 by applying descriptive statistics, one can note that the average value of the SSR in the Republic of Moldova represents 126% and the IDR 35%.

In 2022, when the hostilities in region started, these values accounted for 130.00% and 59.78%, respectively (Fig. 5).

Therefore, both indicators exceeded the average of the analyzed period.

Thus, in the case of SSR, one can notice a positive signal that indicates an increase in the self-sufficiency level; then, in the situation of increasing the IDR, it is a negative signal because the dependence on imported agri-food products has increased.

For a deeper understanding of the relationship between the level of food self-sufficiency of the Republic of Moldova and the export of agri-food products, it is opportune to determine the correlation between these two variables.

It is generally accepted that the strength of the correlation coefficient, as an indicator of the

degree of interdependence, differentiates into three levels for both positive and negative correlations.

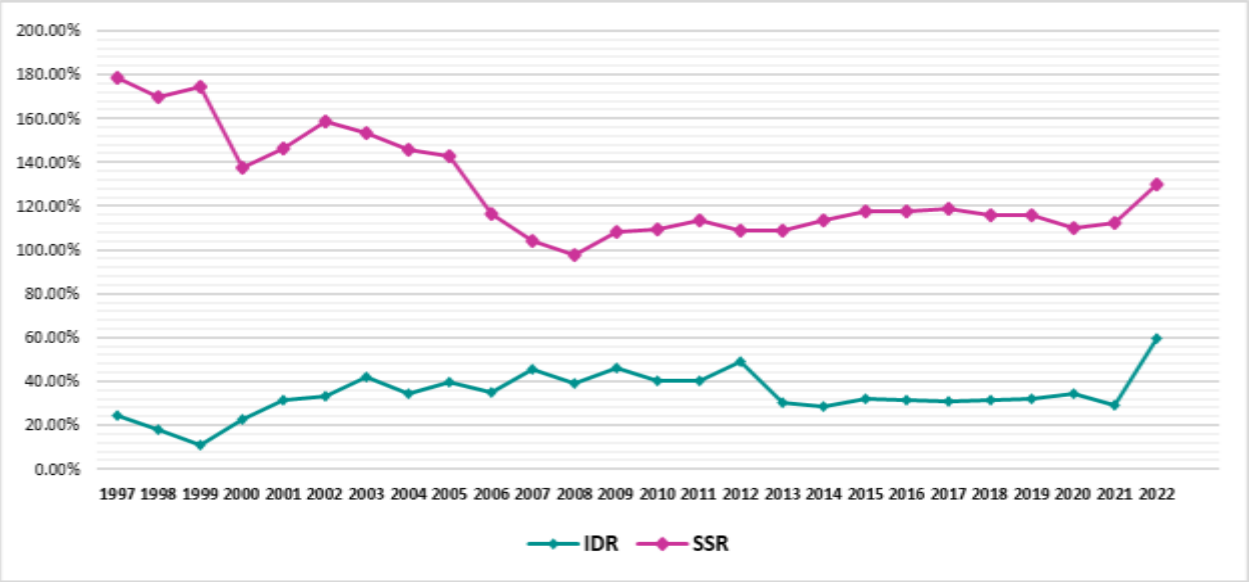


Fig. 5. Republic of Moldova's Self-Sufficiency Ratio and Import Dependency Ratio dynamics
Source: Own results.

In the case of the Republic of Moldova, there is a weak positive relationship between the export of agri-food products and SSR, (ρ =0.218), which means that the export of Moldovan agri-food products, for the most part, should not affect the food security of the country (Fig. 6).

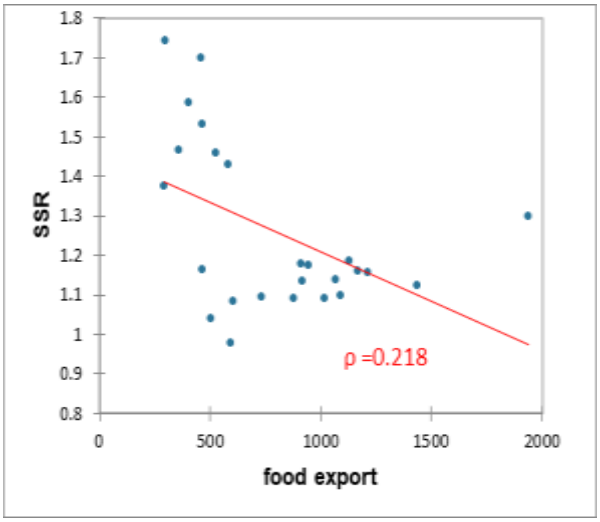


Fig. 6. Correlation among food export and SSR
Source: analysis data.

Moldovan agri-food exports depend on the external market fluctuations and the appearance of the hostilities in the region produced important changes in structure of its agri-food exports (Fig. 7).

Figure 7 shows that the most vulnerable category is apples and pears, as 97% of this category was exported to Russia, its share being 6% of the total exports of agri-food products (ITC, 2021) [10].

Two other essential categories are grapes and cherries, apricots, and peaches. Therefore, under the created conditions, the governors had to find new markets relatively quickly.

Food security has become a serious issue due to the increase in the quotations of agricultural products in the commodity market, which could have led to increased exports of these products as well as a shortage in the domestic market. In this context, the authorities have introduced restrictions on the export of the following agricultural products: wheat; flour; maize; sunflower. These bans were gradually repealed.

However, it should be noted that even in the conditions of some restrictions on the export of some categories of agri-food products, but also of the difficulties of accessing the traditional markets for the sale of other products, in 2022, there were increases in the export of the following categories: cereals (111.35%), products of the milling industry, malt, starch, insulin, wheat gluten (335.90%), oleaginous seeds and fruits, various seeds and

fruits, industrial and medicinal plants, straw, and fodder (152.32 %), preparations based on cereals, flour, starch, starch or milk pastry products (120.51%), vegetable preparations, from fruits, nuts, or other plant parts (136.31%).

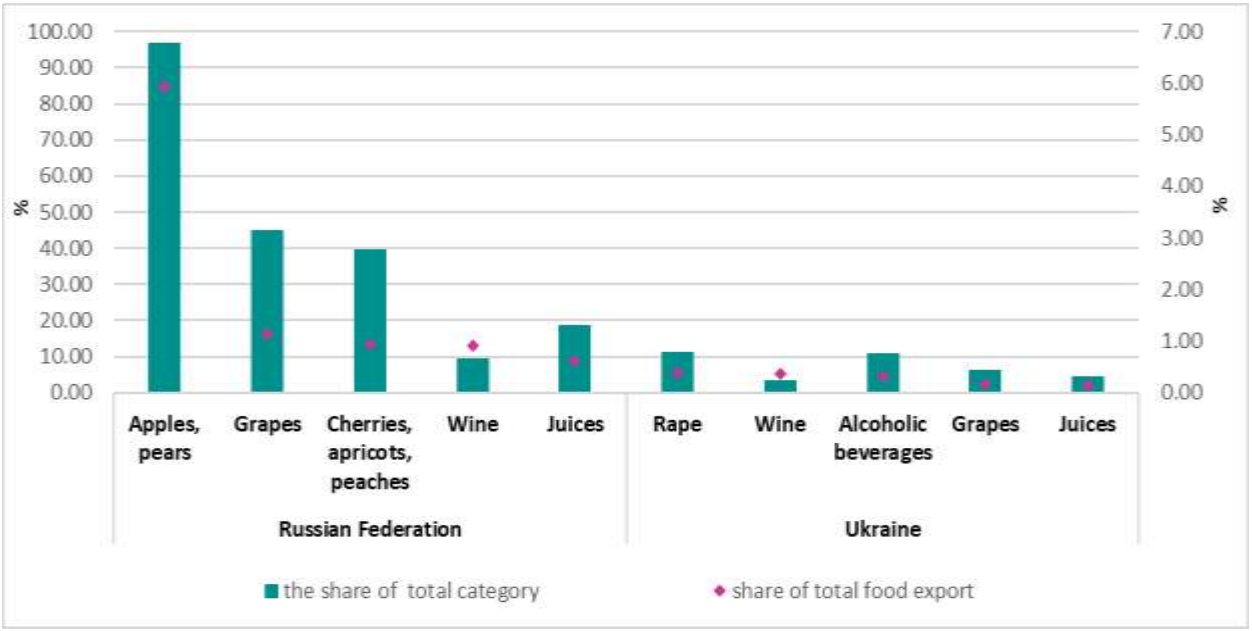


Fig. 7. The main categories of food products exported to Russia and Ukraine, %, 2021
Source: ITC, 2021 [10].

At the same time, we must emphasize that the specifics of the economy of the Republic of Moldova, as well as the current situation, indicate the fact that the country's self-sufficiency level is close to 100% for most food products, except for some products, such as butter (58.5%); poultry meat (66.7%); tomatoes (40.4%); cucumbers (63.5%); potatoes (68.5%); oats (33.0%).

Figure 8 shows that, for the most part, the Consumer Price Index-CPI of agri-food products exceeded the total CPI in 2022.

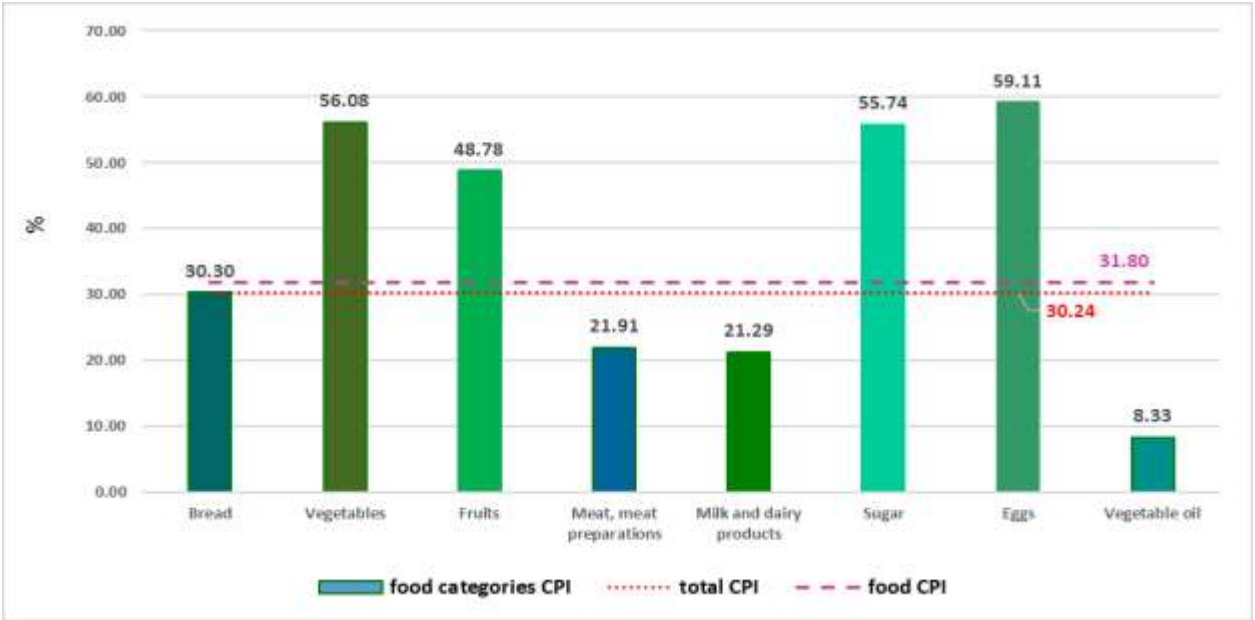


Fig. 8. The Consumer Price Index for the main food products, %, 2022
Source: NBS.(2022, b) [14].

The most significant increase was recorded in the following categories: eggs (59.1%), vegetables (56.08%), and fruits (48.78%). This evolution of the CPI for agri-food products can be considered alarming for the resilience of the food security of the Republic of Moldova ( Fig. 8).

The crucial issue in food security is not the physical availability of food products, but the physical access to them.

In this context, the evolution of the CPI for the main agri-food products, in 2022, shows us the area with which the authorities of the Republic of Moldova must be concerned, in order not to allow food insecurity for the vulnerable categories of citizens of the Republic of Moldova.

## CONCLUSIONS

The long-standing debates on the meanings of foreign trade as a threat or an opportunity for food security remain, to date, under examination. The potential of exporting essential agri-food products, correlated with food security, constituting multidimensional problems that connect directly with national economies, is in constant tension in a rapidly changing global environment. This process forces global economic governance, on the one hand, and national governments, on the other, to design a framework to address food security resilience, concurrently with export fortification, to adapt it to its goals. It also induces the scientific community from the field to reflect on the complex nature of food security, bringing new visions and methodologies that would facilitate foreign trade.

Under these conditions, the economy of the Republic of Moldova, being a small and open one, is exposed to all the processes carried out within the global economy under the influence of internal and external vulnerabilities. Therefore, the multitude of risks to which both food security and foreign trade are subject have repercussions on the functioning of the economic system of the Republic of Moldova and, therefore, on the population's well-being.

The recognition of the relevance of the sustainable economic development of food security and the strengthening of exports of the main agri-food products, particularly in the conditions of cataclysms, determined the need for research in this field.

The Republic of Moldova has a sensitive economy and exogenous shocks instability on the international market could deeply affect the country foreign trade.

In last period, because of the instabilities in the region, on the one hand, the traditional export markets of some categories of agri-food products were impossible to access, on the other hand, food security risks intensified as in consequence of the potential growth in exports because of the increase in the prices of agri-food products on the international market.

However, the most substantial impact on the resilience of food security in the Republic of Moldova had the significant rise in the inflation of agri-food products caused by increased prices of imported energy resources.

## ACKNOWLEDGEMENTS

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# VARIATION OF FLOWER QUALITY IN *Liatris spicata* IN RELATION TO PLANTING DATE AND FERTILIZATION SYSTEM

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***Abstract***

*The study evaluated the quality of the flowers of the species Liatris spicata (L.) Wild., in relation to the date of planting and the fertilization applied. Planting was done at three different times, March 6 (PD1), March 13 (PD2) and March 20 (PD3). At planting, and at the formation of the floral stem, vermicompost type fertilizers were applied, in solid (VC-S) and liquid (VC-L) form, independently and in combination (VC-S/VC-L). Nine experimental variants resulted, including the control variant (T1 to T9). At the time of flowering, plant height (PH), flower stem length (FSL) and spike flower length (SL) were evaluated. The highest value for plant height was recorded under the conditions of planting date PD1 and fertilization VC-S/VC-L (T1), PH=52.05±1.11 cm. In the case of flower stem length (FSL), the highest value was in the PD1 variant with VC-S/VC-L fertilization (T1), FSL=42.70±1.44 cm. The highest value for the length of the spike-shaped inflorescence (SL) was recorded for variant PD2 with VC-S/VC-L fertilization (T4), respectively SL=9.95±037 cm. Polynomial equations of the 2nd degree described the variation of SL in relation to PH ($R^2$=0.968, p<0.001) and FSL ($R^2$=0.862, p=0.00264). According to PCA, PC1 explained 92.907% of variance, and PC2 explained 7.093% of variance. Regression analysis was used to evaluate the variation of SL in relation to PH and FSL, as a direct and interaction effect. 3D and isoquants models, plane format, were obtained to describe the variation of SL in relation to PH and FSL.*

***Key words:*** *flower quality, Liatris, model, ornamental plants, vermicompost*

## INTRODUCTION

Ornamental plants present a very high diversity through the large number of species and genotypes, through the ornamental elements (flowers, leaves, or their combinations), the architecture and typology of the plants, the space for which they are intended to be used (indoor, outdoor), the period of vegetation, relationship and tolerance to climatic conditions and stress factors, etc. [1, 8, 11, 18, 39]. They are not just "luxury", but a primordial-functional human necessity, because they allow and at the same time facilitate people to realize in increasingly anthropized urban ecosystems, elements through which to connect with nature, and facilitate multiple functionalities [7, 11, 13, 25]. Ornamental plants, accompanied by specific horticultural practices, offer multiple functions and benefits, aesthetic, social, ecological, economic, etc. [4, 11, 14]. As a result of the interest in ornamental plants, from different perspectives, a particularly important field of ornamental plants has developed, considered as "ornamental plant industry" as a result of the economic contribution of this field [4].

In the case of ornamental plants through flowers, the defining ornamental elements (flowers), show importance by size, color, length of the floral stem (in the case of cut flowers), period and duration of flowering, etc. [2, 10, 11].

The improvement of ornamental plants through flowers is a basic concern in order to obtain new genotypes and improve floral attributes for aesthetic, cultural, technological and market purposes [19, 26, 30, 34]. Technological procedures (cultivation / maintenance technologies) to produce ornamental plants and control floral attributes are of interest [3, 22. 31, 32].

*Liatris spicata* (L.) Wild., known as "Blazing star", is a perennial species, from the Compositae Family, originating in North America. The genus Liatris is a taxonomic group that includes approximately 37 species [29] distributed in almost all American states, east of the Rocky Mountains to Southern Canada and Northern Mexico

*Liatris spicata* is the most cultivated species; it grows in full sun but also tolerates less light [35]. The soil must be well drained, with favorable physico-chemical and microbiological parameters [33], but plants also tolerate soils with low fertility, but too fertile lands (especially nitrogen) lead to the disappearance of corms from the soil.

More and more landscapers from different countries are looking for solutions to create an adequate biodiversity in urban areas, which are increasingly crowded and polluted. In more and more countries, perennial flower species are used for the arrangement of urban green spaces, along with decorative grasses and woody species [27, 36, 37]. Some studies evaluated urban ecosystems at a microzonal level based on test plants, indices and expressive parameters [5], while other studies evaluated urban ecosystems on a large scale, through remote sensing techniques [17], in order to characterize these anthropogenic ecosystems. Imaging analysis was used to evaluate the qualitative ornamental aspects of some perennial urban landscapes [36], and from the perspective of small-scale evaluation (at leaf level), imaging analysis proved to be very useful in early, non-destructive detection, of the health status of the plants [6]. The present study aimed to evaluate some qualitative aspects of the species *Liatris spicata* (L.) Wild., in relation to the date of planting corms, and fertilization, using for this floral attributes given by the floral stem, flower size, and used regression analysis to find models of description of the variation of the floral size in relation to the biometric parameters of the plants.

## MATERIALS AND METHODS

The study took place within the Teaching and Research Base, University of Life Sciences "King Michael I" from Timisoara, between March and July, 2018. For planting Liatris corms, pots and universal substrate were used with the properties: pH=5.0–7.0, N=1.9%, $P_2O_5$=0.5%, $K_2O$= 0.9% (contents related to dry matter). For fertilization, vermicompost was used in solid form (VC-S), in liquid form (VC-L) applied independently or combined (VC-S / VC-L). Planting was done at three different times, namely on March 6 (PD1), March 13 (PD2) and March 20 (PD3).

The biological material was represented by Liatris corms (*Liatris spicata*), of superior quality, Figure 1.

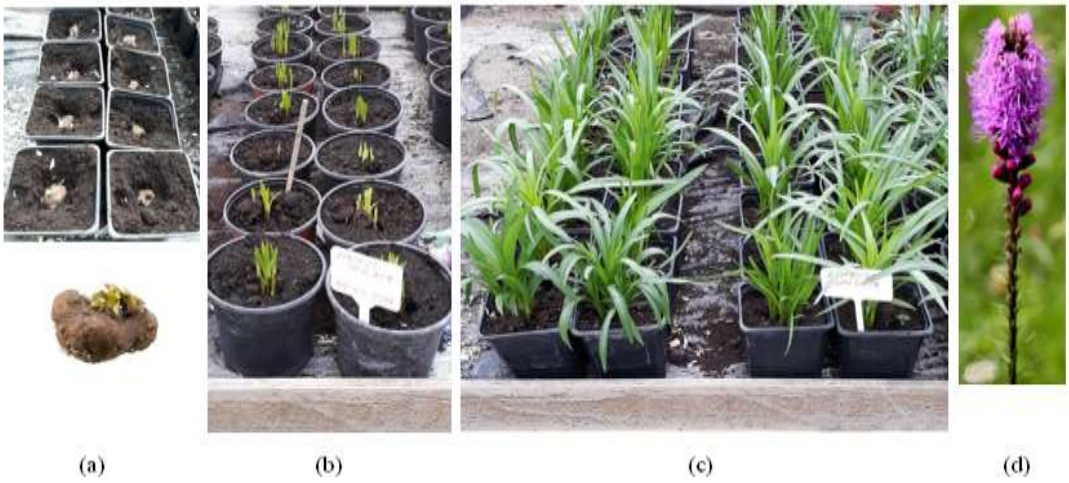



Fig. 1. Sequential aspects of the *Liatris spicata* experiment; (a) – corm, and corms at sprouting; (b) – sprouted plants; (c) - plants in the vegetation stage; (d) Liatris flower, single stem
Source: Original photos.

From the combination of the planting data (T1, T2, T3), of the fertilization system (VC-S, VC-L, or VC-S/VC-L), nine experimental variants (T1 to T9) resulted. The experiments were organized in three repetitions, and sequential aspects of the experiment are presented in Figure 1.

In relation to the specificity of plants and flowers as an ornamental and commercial product, in order to appreciate the quality of the flowers, the height of the plants (PH), the length of the floral stem (FSL) and the length of the inflorescence in the form of a spike (SL) were evaluated, in relation to each experimental variant.

The recorded results were properly analyzed, through appropriate mathematical and statistical methods, to evaluate the safety of the data, the presence of variance in relation to the experimental variables, the differences between the variants, as well as the particularities of the variants in the generation of quality results. A series of tests and specific statistical analyzes were made; Anova test, PCA analysis, cluster analysis, regression analysis, correlation analysis, and appropriate parametric statistics were used to assess the reliability of the results [15, 38].

## RESULTS AND DISCUSSIONS

The plants of *Liatris spicata* (L.) Wild were evaluated in relation to the date of planting and the nutrition provided based on the vermi-compost product (solid or liquid form) administered differently at planting and in vegetation, at the formation of the floral stem. The ornamental quality of the plants was evaluated, based on the height of the plants (PH), the length of the floral stem (FSL) and the length of the inflorescence in the form of a spike (spike length - SL).

High quality, with a high commercial value, is considered in the case of a developed inflorescence (long, well-developed spike), with a long floral stem, which is obtained from well-developed plants, associated with a performing biological material and an appropriate technology of culture.

The recorded values were compared with a control variant (Ct). The results recorded for the parameters and quality indices considered, in relation to the ornamental specifics of the studied species, are presented in Table 1.

The highest value for plant height was recorded under the conditions of PD1 planting date and VC-S/VC-L fertilization (T1), PH=52.05±1.11 cm. In the case of flower stem length (FSL), a high value for the analyzed parameter was recorded in the PD1 variant with VC-S/VC-L fertilization (T1), FSL=42.70±1.44 cm.

The highest value for the length of the spike-shaped inflorescence (SL) was recorded in the PD2 variant with VC-S/VC-L fertilization (T4), respectively SL=9.95±037 cm.

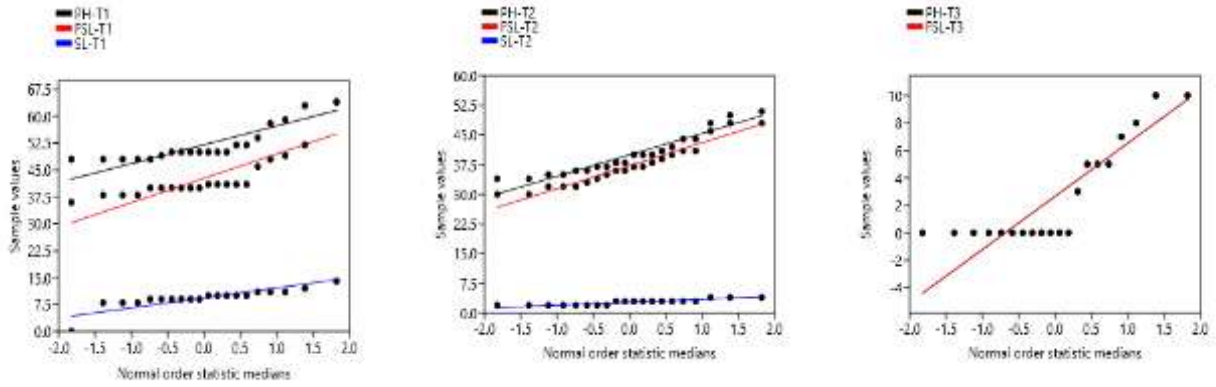
Table 1. The values recorded for *Liatris spicata* in relation to the planting date and applied fertilization

| Planting date | Fertilization | Trial | PH | FSL | SL |
|---|---|---|---|---|---|
| | | | (cm) | | |
| PD1 | VC-S/VC-L | T1 | 52.05±1.11 | 42.70±1.44 | 9.35±0.59 |
| | VC-L/VC-L | T2 | 40.00±1.15 | 37.25±1.22 | 2.75±0.16 |
| | Ct | T3 | 6.63±0.82 | 6.63±0.82 | 0.00±0.00 |
| PD2 | VC-S/VC-L | T4 | 49.15±0.34 | 39.20±0.36 | 9.95±0.37 |
| | VC-L/VC-L | T5 | 38.65±1.00 | 35.35±0.83 | 3.30±0.33 |
| | Ct | T6 | 7.00±0.82 | 7.00±0.82 | 0.00±0.00 |
| PD3 | VC-S/VC-L | T7 | 49.60±0.59 | 39.90±0.57 | 9.70±0.37 |
| | VC-L/VC-L | T8 | 37.00±0.73 | 34.50±0.67 | 2.50±0.13 |
| | Ct | T9 | 7.50±0.82 | 7.50±0.82 | 0.00±0.00 |

Source: Original data.

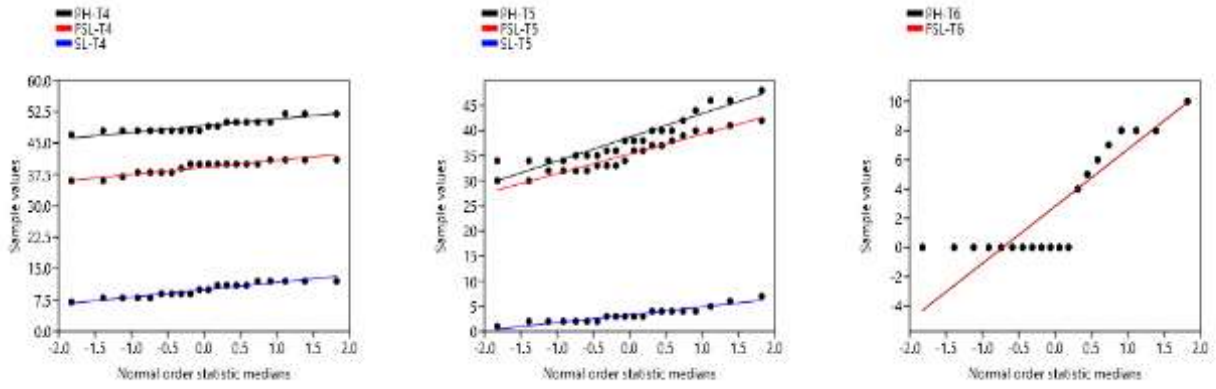
The ANOVA test confirmed the reliability of the results as well as the presence of variance in the set of recorded experimental data ($F>F_{crit}$, $p<0.001$).

The distribution of data values for each parameter (20 values for each data series) was analyzed and displayed in graphic form (normal probability plot). In the case of the PD 1 planting date (March 6), the distribution of the data series by variants is represented in Figure 2 (a, b, c), under statistical safety conditions, assessed on the basis of the correlation coefficient (r=0.874 for PH-T1, r=0.843 for FSL-T1, r=0.845 for SL-T1, in fig. 2 a; r=0.956 for PH-T2, r=0.969 for FSL-T2, r=0.902 for SL-T2 in fig. 2 b; r=0.863 for PH-T3 and for FSL-T3, in fig. 2 c). In the case of the PD 2 planting date (March 13), the distribution of the data series by variants is represented in figure 3 (a, b, c), under statistical safety conditions, assessed on the basis of the correlation coefficient (r= 0.919 for PH-T4, r=0.934 for FSL-T4, r=0.957 for SL-T4 in Fig. 3 a, r=0.947 for PH-T5, r=0.974 for FSL-T5, r=0.949 for SL-T5 in Fig. 3 b; r=0.863 for PH-T6 and for FSL-T6 in fig. 3 c). In the case of the PD 3 planting date (March 20), the distribution of the data series by variants is represented in figure 4 (a, b, c), under statistical safety conditions, assessed on the basis of the correlation coefficient (r=836 for PH-T7, r=0.899 for FSL-T7, r=0.966 for SL-T7 in fig 4a; r=0.966 for PH-T8, r=0.973 for FSL-T8, r=0.853 for FS-T8 in fig 4b; r=0.862 for PH-T9 and for FSL-T9 in fig 4 c).



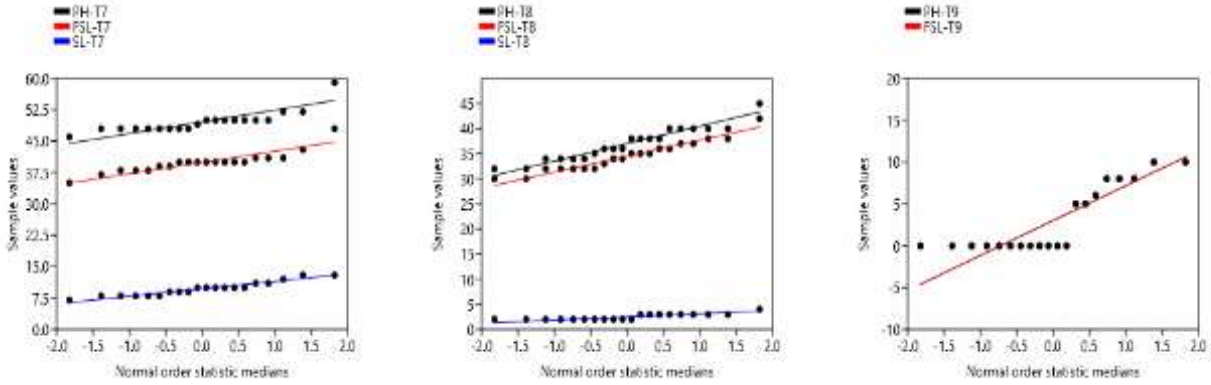

A b c

Fig. 2. The graphic distribution for the data series of the plant samples (PD1), *Liatris spicata* species
Source: Original figure, based on the data.




A b c

Fig. 3. The graphic distribution for the data series for the plant samples (PD2), *Liatris spicata* species
Source: Original figure, based on the data.




A b c

Fig. 4. The graphic distribution for the data series for the plant samples (PD3), *Liatris spicata* species
Source: The original figure, based on the data.

The variation in the interdependence of the evaluated parameters was highlighted by regression analysis. Thus, the variation of FSL in relation to PH was described by equation (1) under conditions of $R^2$=0.997, p<0.001, F=1262.9. The variation of FS in relation to PH was described by equation (2) under conditions of $R^2$=0.968, p<0.001, F=91.854. The variation of FS in relation to FSL was described by equation (3) under conditions of $R^2$=0.862, p=0.00264, F=18.688.

$$FSL = -0.01046 \cdot PH^2 + 1.38 \cdot PH - 2.148 \quad (1)$$

$$SL = 0.01046 \cdot PH^2 - 0.3803 \cdot PH + 2.148 \quad (2)$$

$$SL = 0.02596 \cdot FSL^2 - 0.9776 \cdot FSL + 5.577 \quad (3)$$

where: FSL - floral stem length;
PH – plant height;
SL – spike length.

Based on the PCA, the distribution diagram of the variants (T1 to T9) was obtained in relation to the values of the evaluated parameters (as biplot), generated by the date of planting and the fertilization applied, Figure 5.

The independent positioning of the variants T3 (PD1 Ct), T6 (PD2 Ct) and T9 (PD3 Ct) was found, which recorded the lowest values for the parametrically evaluated.

The variants T2 (PD1 VC-L/VC-L), T5 (PD2 VC-L/VC-L) and T8 (PD3 VC-L/VC-L) were associated with FSL.

The variants T1 (PD1 VC-S/VC-L), T4 (PD2 VC-S/VC-L) and T7 (PD3 VC-S/VC-L) were positioned associated with SL. PC1 explained 92.907% of variance, and PC2 explained 7.093% of variance.

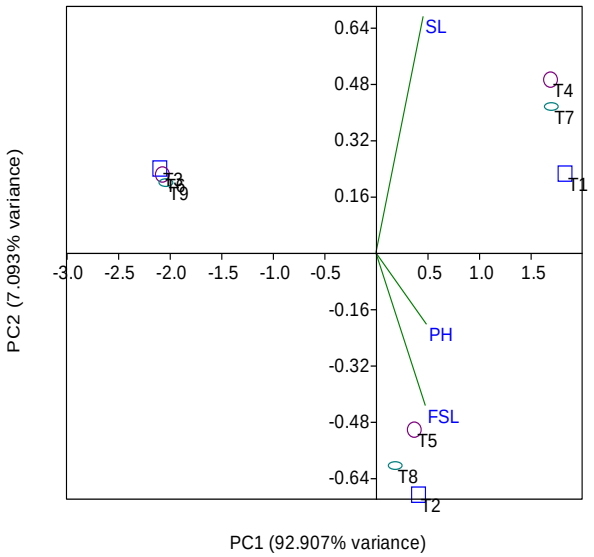



Fig. 5. PCA diagram, correlation, regarding the distribution of variants in the *Liatris spicata* species, in relation to evaluated parameters
Source: The original figure, based on the data.

The cluster analysis led to the dendrogram in Figure 6, under statistical safety conditions (Coph.corr=0.974). A high level of similarity was recorded between the T6 and T9 variants (SDI=0.52326), followed by the T6 and T9 variants (SDI=0.70711).

These variants were included in a cluster with the lowest values for the evaluated floral quality parameter. In the cluster with high values (quality flowers) the variants T1, T4 and T7 were included, within which a high level of similarity was recorded between the

variants T4 and T7 (SDI=0.86891).

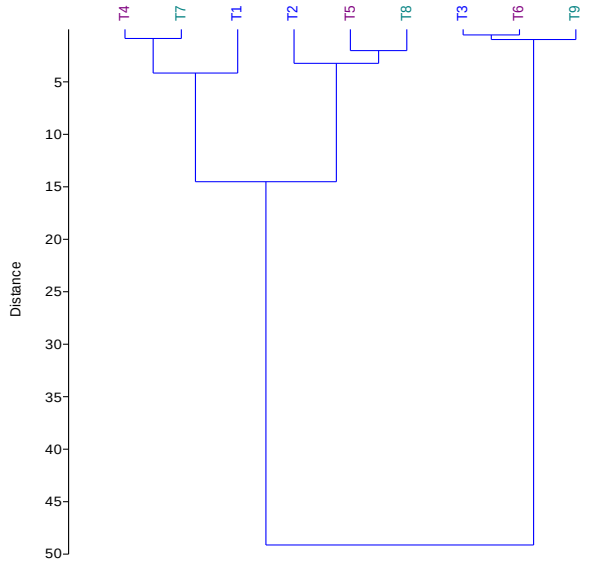



Fig. 6. Dendrogram for the classification of variants based on similarity in generating the values of the parameters studied in *Liatris spicata*
Source: Original figure.

Regression analysis was used to evaluate the variation of SL in relation to PH and FSL. Equation (4) was obtained, as a general type relationship, which described the variation of the flower quality parameter considered in the study (SL), and the values of the coefficients of the equation for the three planting dates, as study cases in the analysis of regression, and statistical safety parameters, are presented in Table 2. The graphic distribution of the variation of SL in relation to FSL and PH on the three considered experimental variants are presented in Figures 7 (T1), 8 (T4) and 9 (T7). The ANOVA test led to obtaining the values of the statistical safety parameter (p), corresponding to equation (4) in relation to each analysis performed (T1, T4 and T7). According to the p values, statistical certainty was recorded for $x$ ($p<0.001$) and $y$ ($p<0.001$) in the case of variants T1 and T7, respectively for $x$ ($p<0.001$), $y$ ($p<0.001$), $x^2$ ($p= 0.0016$), $y^2$ ($p=0.0042$), and $xy$ ($p=0.00077$), in the case of the T4 variant.

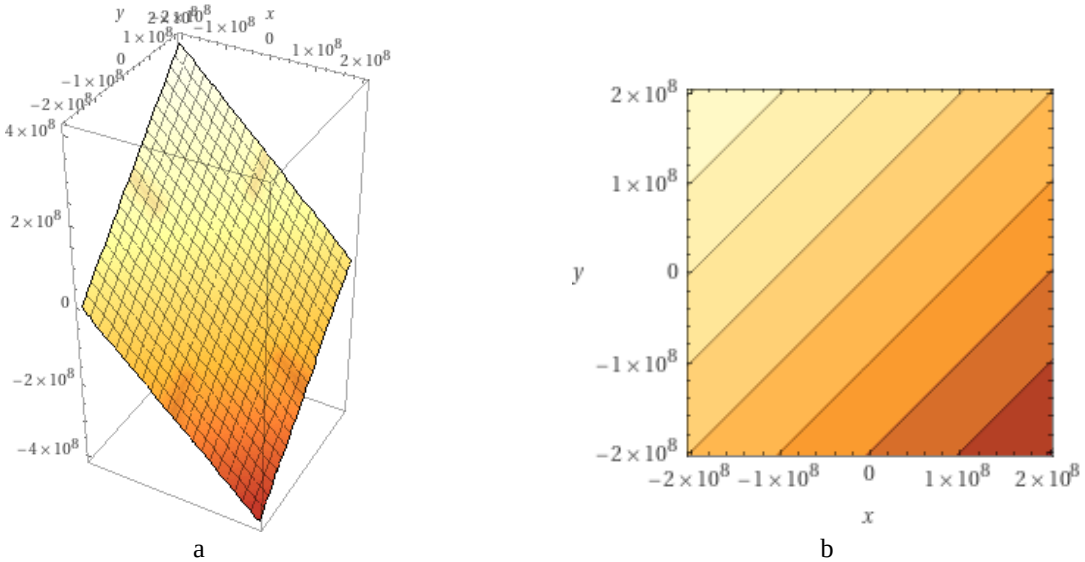
$$SL = ax^2 + by^2 + cx + dy + exy + f \quad (4)$$

where: SL – the length of the spike-type inflorescence; $x$ – floral stem length (FSL); $y$ – plant height (PH); a, b, c, d, e, f – coefficients of the equation (4), Table 2.

Table 2. The values of the coefficients of equation (4), in relation to PH and FSL parameters on experimental variants

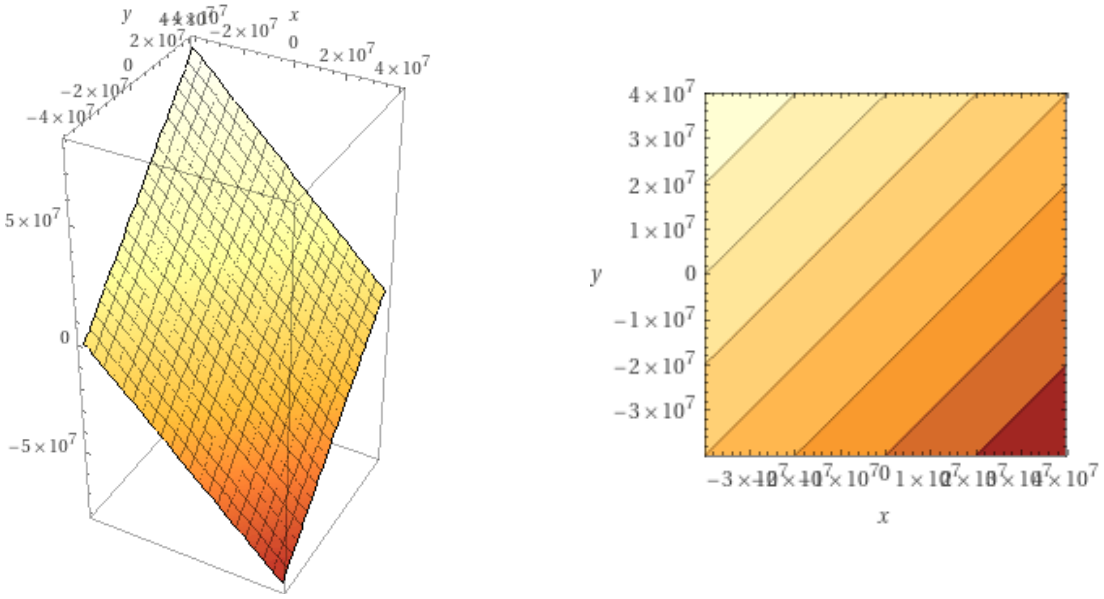
| coefficients of equation (4) | Values of the coefficients on the analyzed experimental variants | | |
|---|---|---|---|
| | T1 | T4 | T7 |
| a | -7.72124E-17 | 3.58323E-15 | -4.52357E-16 |
| b | -1.43183E-16 | 3.06353E-15 | 2.74626E-16 |
| c | -1 | -1 | -1 |
| d | 1 | 1 | 1 |
| e | 2.45865E-16 | -6.67804E-15 | -4.64266E-17 |
| f | 0 | 0 | 0 |

Source: Original data.



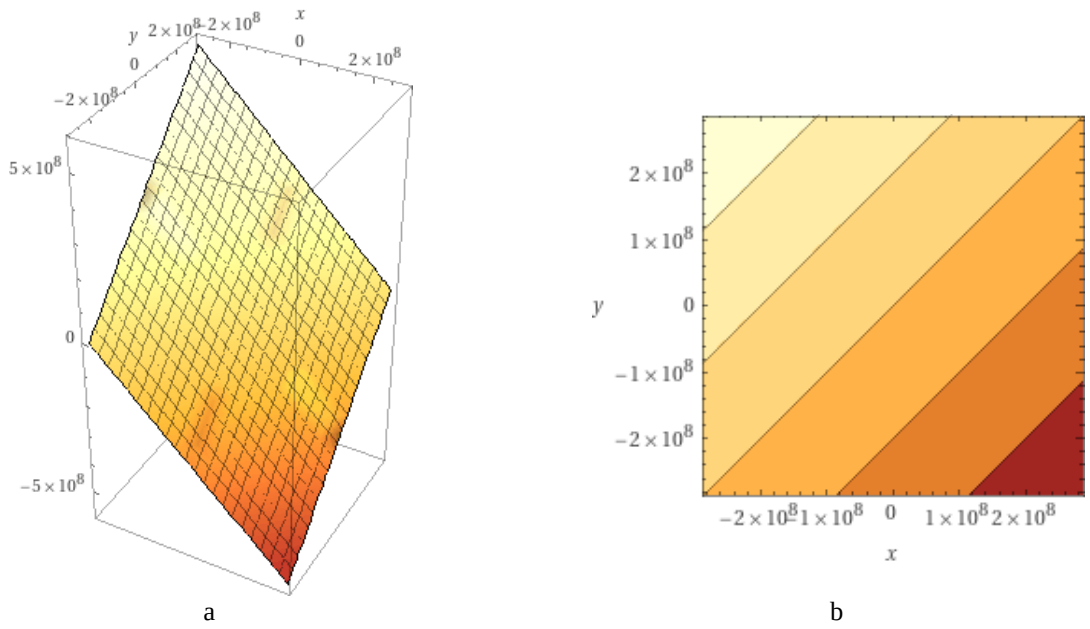

a b

Fig. 7. Distribution of SL values in relation to FSL (x-axis) and PH (y-axis), in the case of variant T1; a – 3D model; b – model in the form of isoquants, plane format
Source: original graphs.




a b

Fig. 8. Distribution of SL values in relation to FSL (x-axis) and PH (y-axis), in the case of variant T4; a – 3D model; b – model in the form of isoquants, plane format
Source: original graphs.




a b

Fig. 9. Distribution of SL values in relation to FSL (x-axis) and PH (y-axis), in the case of variant T7; a – 3D model; b – model in the form of isoquants, plane format
Source: original graphs.

Green spaces are important in urban ecosystems, and have complex functionality, aesthetic, emotional, ecological, social, etc. [16, 20, 36].

*Liatris spicata* (L.) Wild., was present together with other species of perennial herbaceous plants (29 species and varieties), in the framework of a design study of perennial landscapes in urban areas (Shanghai and Hangzhou), in which the importance of the species was analyzed by their typology and the way of arrangement (six studied models) on the perception of people's gaze and aesthetic preferences [36. Similar studies, regarding the floristic diversity in urban gardens and green spaces (Zurich, Switzerland) have identified and reported the presence of the species *Liatris spicata* in some gardens [12].

*Liatris spicata* was taken into account, in a

study that included 31 plant species, in order to evaluate the behavior of plants in conditions of combined stress, specific to the conditions of green spaces along roads and streets, in cold and humid climate conditions (eg. Norway) [23]. The authors reported considerable differences between the adaptation of the tested plant species to the study conditions, and the species *Liatris spicata* 'Floristan Weiss' was among the species with a high survival rate in the study conditions.

Also, *Listris spicata* was considered in a study, together with other species, regarding the impact of conscious, intentional and programmed plantings of wild flowers, on native plant species in urban and peri-urban habitats, and *Liatris spicata* obtained 3.1 points in Species Impact Index [21].

The relationship and response of Liatris plants in relation to climatic and cultivation factors have been addressed in some studies. Shoot formation in *Liatris spicata* was studied in relation to the soil temperature and the time of planting, respectively the photoperiod in which the plants grew, and it was found that the temperature but also the photoperiod influenced the growth and development of the Liatris plants, especially in the first 35 days of vegetation [9].

Moe and Berland (1986) [28] reported the favorable influence of low temperature during the storage period of Liatris corms on the flowering time and the number of shoots. Also, the authors found the favorable influence of gibberellic acid (GA3, 500 ppm) on the development of flowers and the number of flower shoots, by reducing the time until flowering and increasing the number of flower shoots on the corm, important aspects for practice.

Interest in Liatris was also presented from the perspective of obtaining essential oils. In a study on eight plant species, including Liatris, several components were detected, and the Germacrene D component was reported as a major component in Liatris samples, in a proportion of 24% [24].

The specificity of this study, regarding the qualitative assessment of Liatris flowers based on some vegetative and floral parameters, led to obtaining numerical data, as effective values of the parameters determined in relation to influencing factors (planting date, fertilizers), as well as data in the form of equations, diagrams and graphic models (3D or isoquants), which can be useful in other studies. At the same time, the study models used can be adapted to other species of ornamental plants with similar attributes, in order to optimize their cultivation.

## CONCLUSIONS

Liatris plants responded differently to the time of planting (three planting dates; PD1, PD2, PD3) and applied fertilization (vermicompost in solid and liquid form; VC-S, VC-L, VC-S/VC-L) and led parametrically variable floral quality, especially in terms of spike length (SL).

The PCA and cluster analysis facilitated the generation of diagrams and dendrograms by which the assimilation of the considered parametric variants was quantified, as well as the degree of similarity of the nine variants in the generation of answers with the closest value, under conditions of statistical certainty.

Through the regression analysis, models in the form of equations, and 3D and isoquant graphic models were obtained, which described the behavior of Liatris plants under the study conditions with statistical certainty.

The obtained results confirm the fact that the quality of the flowers can be directed by the cultivation technology (planting date, fertilization in the present study), in relation to their intended use.

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# ANALYZING PRESENT AND FUTURE CONNECTIONS BETWEEN FARM MANAGEMENT AND PERFORMANCE: COMPARATIVE STUDY USING STATISTICAL METHODS AND SUPERVISED LEARNING

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***Abstract***

*The determination of the influences of the management on the economic performance of an agricultural holding can be an important process for the farm manager, as a source of information which can consist in a valuable component needed in the decisional process. In this matter, the analysis is useful during a specific period of time, which also comprises future predictions. In this paper, we will present a study of the connection between the farm management approach, represented by several characteristics of the farm and the farmer, and the farm economic performance, represented by the financial result of the farm activity. This study is presented as a comparative analysis of two methods that establish the existence and intensity of the mentioned connection, the first one being based on statistical methods and instruments and the second one being based on machine-learning based tools, specifically supervised learning. This study aims to find alternative means of studying causal implications of the management type on the economic activity within a farm, based on digital-based tools. The obtained results for the mentioned research showed that the methods based on supervised learning can be an important tool of analysis, being complementary with the traditional statistical methods regarding the analysis of the microeconomic agricultural environment and performance, providing supplementary key data regarding the economic indicators.*

***Key words*****:** *farm, manager, supervised learning, regression*

## INTRODUCTION

The development of the digital-based methods used for the analysis of certain phenomena had a great implication on the possibility of the performance improvement in a great deal of domains.
This trend is supported by the extent of the digital instruments that are used in various context, including the economic ones. In this matter, the determination of causal implications of certain indicators on the economic performance can be made and improved using methods that take into account a great deal of variables, generated as a form of Big Data from the surrounding environment.
This gain of capability in computing a great deal of variables and parameters lead to a better understanding of the phenomena and, as a direct effect, to a better decisional system within an economic environment.
In the economic field, a special attention must be given to the micro-level of a national economy, namely at the enterprise level. In agriculture, one of the most important causal relationships that affects the economic performance is made with the managerial decisions within an agricultural holding.
The managerial decisions are based on an entire set of previous experiences, known as educational background and work experience. One of the most known modalities to achieve a good educational background is the initial education, but other forms of formal education, such as training, have also a great deal of impact on the educational background of the manager of the agricultural holding.

Thus, we can imply that a direct connection between the educational training type of the farm manager and the economic performance of the farm can be established. Our approach was based on the general classification of the educational agricultural training types, namely elementary training, exclusively practical training and complete agricultural training, and the association of the economic performance of the farm with the profit indicator.

Regarding the short description of the training types, we can consider (Eurostat, 1996) [2], (NIS, 2020) [8]:

-the elementary agricultural training is considered for those who have completed any training cycle in a basic agricultural education school and/or in a training center that is oriented towards certain disciplines (horticulture, viticulture, forestry, pisciculture, veterinary science, technological agriculture and related disciplines);

-the exclusively practical training refers to the experience gained through practical work on a farm;

-the complete agricultural training refers to the completion of courses specific to agriculture, lasting at least two years after the completion of compulsory education completed in an agricultural school, college or university.

This paper presents a study related to the existence and the intensity of a relationship between the two variables presented previously.

Moreover, this paper also aims to present a comparative analysis between the traditional methods used for the determination of the mentioned relationship, using statistical methods, and an empirical perspective on the usage of information technology-based methods, namely from supervised learning (Imandoust & Bolandraftar, 2013) [4] area, that can lead to innovative methods for the analysis of the mentioned relationship.

In order to accomplish this objective of the paper, a study on this relationship has been designed using statistical instruments (the questionnaire) and implemented for a determined number of farm managers during September – December 2020. The results of the implementation of the questionnaire were then processed and analyzed using the association test and also analyzed using supervised learning methods (Khan, și alții, 2022) [6], (Shin, Hou, Park, Park, & Choi, 2013) [11], namely regression and k-Nearest Neighbor (kNN) algorithm, which measures the Euclidean distance between the points in order to establish a correlation between them.

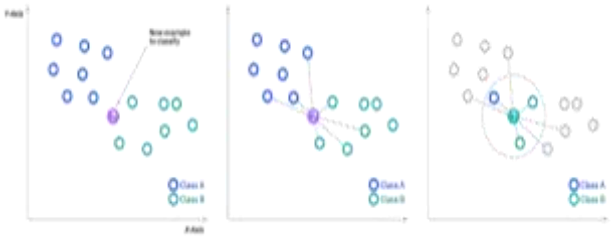


Fig. 1. Description of the kNN algorithm
Source: IBM (2023) [3].

kNN method is used in various domains and the list of domains includes the agriculture, in this matter the applications being used especially for predictions (Samhith, Rajinikanth, & Kavya, 2022) [10], crop performance (Reddy & Kumaran, 2023) [9], (Kaur, Gulati, & Kundra, 2014) [5] or farm machinery (Waleed, Um, Kamal, & Usman, 2021) [13].

## MATERIALS AND METHODS \

The study is made based on the analysis and prevision of specific data obtained based on a questionnaire. The questionnaire, invented by Sir Francis Galton, is the most used method for obtaining primary data (Capotă, Popa, & Ghinescu, 2006) [1] used in social and economic studies. In the problems of the socio-economic domains, the association test is applied, after the compilation of contingency tables in which the data are classified according to one, two or more segmentation variables (Mihăiță, 2021) [7]. The questionnaire must have an orderly format, with clear questions that are easy to complete and analyse (Șandor) [12].

For this purpose, specific methods related to statistical and ML-based techniques used for regression and clustering were selected.KNN
In this matter, the statistical part of the comparison is comprised of the usage of the association test (Chi, Hi or theoretical $\chi 2$) for the obtained data of the questionnaire. Data analysis through the association test, introduced by Karl Pearson (1857-1936) in 1900 involves the verification of the hypothesis of association between: the answers obtained in a questionnaire to the alternatives of a question and the verification of a particular set of data which may follow a known statistical distribution. This test allows highlighting the existence/non-existence of an association link between the subgroups created by the studied segmentation variables.

The field survey was conducted in the year 2020 on a sample of 49 respondents, aged between 25 and 70 years old from Olt county, with elementary, exclusively practical or complete agricultural training (Table 1).
The structure of the respondents is as follows:
-34 respondents fall into the age category of 25-44 years, of which 6 have elementary training, 5 exclusively practical training and 23 complete agricultural training;
-12 respondents belong to the age group of 45-65 years, of which 4 have elementary training, 1 exclusively practical training and 7 complete agricultural training;
-3 respondents belong to over 65 category, all 3 from complete agricultural training.

Table 1. The structure of the respondents based on age

| **Professional training** | **MU** | **Age** | | | **Total** | **Percentage** |
|---|---|---|---|---|---|---|
| | | **25 – 44** | **45 – 65** | **>65** | No. | % |
| *Elementary training* | no | 6 | 4 | 0 | 10 | 20.40 |
| *Exclusively practical training* | no | 5 | 1 | 0 | 6 | 12.24 |
| *Complete agricultural training* | no | 23 | 7 | 3 | 33 | 67.34 |
| ***Total*** | no | 34 | 12 | 3 | 49 | 100.00 |
| | % | 69.38 | 24.49 | 6.13 | 49 | 100.00 |

Source: Field survey, 2020.

The test statistic $\chi^2$ equals 3.0272, which is in the 95% region of acceptance: [-∞ : 9.4877]. The requested test was calculated, however, this may not be the right of test for the hypothesis. The priori power is low (0.3514).

Table 2. $\chi^2$ test parameters

| **Indicator** | **Value** | **Explanation** |
|---|---|---|
| k | 3 x 3 = 9 | Number of categories |
| n | 49 | Sample size |
| $\chi^2$ | 3.02719845 51396316 | Chi square test statistic |
| DF | 4 | (Rows-1)*(Columns-1) = (3-1)*(4-1) = 6 |
| Phi effect (Φ) | 0.248555 | $\Phi=\sqrt{(\chi 2/n)}$ |
| DFmin | 2 | Min(Rows-1,Columns-1) = Min(3-1,4-1) = 2 |
| Cramer's V effect | 0.175755 | $V = \Phi/\sqrt{DFmin}$ |

Source: Own results based on the data from Field Survey, 2020.

The farmers' distribution by age is presented in Fig. 2.
Also, the experience of the farmers is an extremely important indicator of their work and performance and will be taken into consideration as a parameter in the analysis of the correlation.

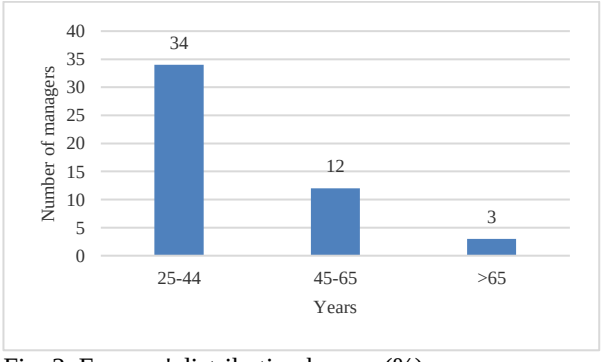



Fig. 2. Farmers' distribution by age (%)
Source: Own results based on the data from Field Survey, 2020.

Figure 3 presents the distribution of the farmers based on their experience in terms of years of work as farm manager.

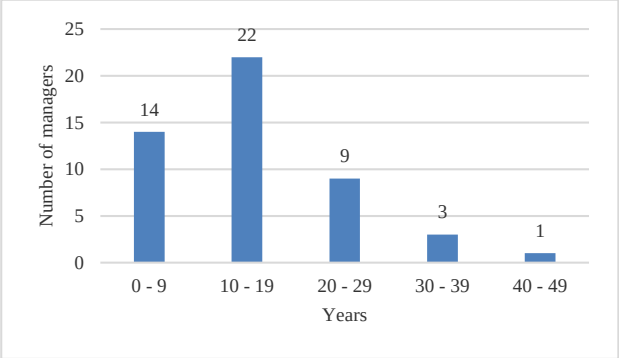



Fig. 3. Farmers' distribution based on their years of experience as farm manager
Source: Own results based on the data from Field Survey, 2020.

The studied farms, numbering 49, belong to three categories of legal forms: Individual Enterprise (IE), Limited Liability Company (LLC), Commercial Company. One of them is a Commercial Company, which is managed by people with elementary training. In the case of LLC type farms, there are 21 companies, from which 2 managers have basic training, 3 exclusively practical and 16 complete agricultural training. In case IE of the 26 farms, 6 administrators have basic training, 3 have exclusively practical and the rest of 17 complete agricultural training.
Figure 4 presents the farmers' distribution according to the profit level category obtained by their company.

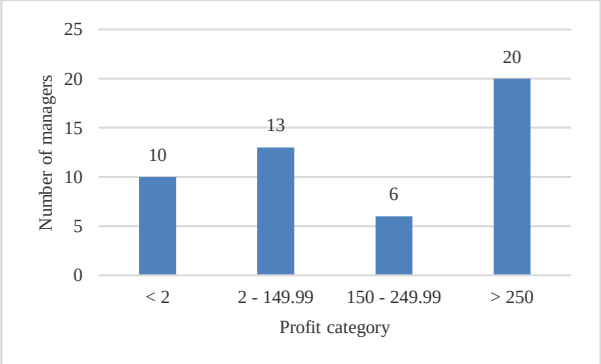



Fig. 4. Farmers' distribution based on the profit category of the company (%)
Source: Own results based on the data from Field Survey, 2020.

The study also consisted of a series of questions regarding respondents' participation in various vocational training courses, hypothesizing that agricultural experience does not influence decisions to attend these courses.
In order to study the correlation between the parameters, we will use the test of hypotheses for the statistical method, based on the difference between the p-value of the association test and the significance level α. In this matter, two hypotheses will be taken into consideration:

- $H_0$: p-value > α;
- $H_1$: p-value ≤ α.

The null hypothesis ($H_0$) will be confirmed if the value of the significance level will be lower than the p-value of the association test.
Related to the kNN algorithm, the steps taken into account are:
S1.The data was is split into train data and test data using specific methods. The training data is used to fit the model, while the test data is used to evaluate the performance of the model.
S2.The Euclidean distances between the points are calculated and normalised. The normalisation consists in the creation of a fair comparison between the calculated distances of the values of the parameters.
S3.A number of neighbours (k) is optimally chosen or determined. defines how many neighbours will be checked to determine the classification of a specific query point.
S4.An instance of the kNN model is created and the train data is fitted.
S5.The model is tested using test data by obtaining the accuracy parameter, which is basically the proportion of the correct answers given by the model compared to the test data.

## RESULTS AND DISCUSSIONS

The profit obtained in most farms, namely 20, exceeds 250,000 euros, in 6 farms it is between 150,000 and 250,000 euros, in 13 farms it is between 2,000-149,999 euros, and less than 2,000 euros were obtained by 10 farms.

The profit in the studied farms is not influenced by the vocational training of the respondents, as indicated by the calculation of the Chi-square test in Table 3.

Table 3. The relationship between training type and farm profit

| Professional training | MU | Farm profit (thousand euro) | | | | Total | |
|---|---|---|---|---|---|---|---|
| | | <2 | 2 – 149.99 | 150 – 250 | >250 | no | % |
| *Elementary training* | no | 2 | 3 | 1 | 4 | 10 | 20.40 |
| *Exclusively practical training* | no | 0 | 1 | 0 | 5 | 6 | 12.24 |
| *Complete agricultural training* | no | 8 | 9 | 5 | 11 | 33 | 67.36 |
| Total | no | 10 | 13 | 6 | 20 | 49 | 100.00 |
| | % | 20.40 | 26.53 | 12.24 | 40.83 | 100.00 | X |

Source: Own results based on the data from Field Survey, 2020.

Expressed as a percentage, the profit obtained in the farms represents more than 30% for 10 farms, between 10-30% for 20 farms, between 2-10% for 8 farms and less than 2% obtained by 11 of the farms (Table 3).
It is found from the type of elementary vocational training, that 6 respondents have profit from 10% to 30% and 4 respondents have profit >30%.

Table 4. $\chi^2$ test parameters

| Indicator | Value | Explanation |
|---|---|---|
| k | 4 x 3 = 12 | Number of categories |
| n | 49 | Sample size |
| $\chi^2$ | 5.850493395493395 | Chi square test statistic |
| DF | 6 | (Rows-1)*(Columns-1) = (3-1)*(4-1) = 6 |
| Phi effect ($\Phi$) | 0.34554 | $\Phi=\sqrt{(\chi 2/n)}$ |
| DFmin | 2 | Min(Rows-1,Columns-1) = Min(3-1,4-1) = 2 |
| Cramer's V effect | 0.244334 | V = $\Phi/\sqrt{DFmin}$ |

Source: Own results based on the data from Field Survey, 2020.

Since p-value > α, $H_0$ is accepted. The statistical model fits the observations, but there is not enough evidence to suggest an association between the professional training type and the profit category. The p-value equals 0.4401, ($p(x\leq\chi^2)$ = 0.5599). It means that the chance of type I error, rejecting a correct $H_0$, is too high: 0.4401 (44.01%). The larger the p-value the more it supports $H_0$. Also, The test statistic $\chi^2$ equals 5.8505, which is in the 95% region of acceptance: [-∞ : 12.5916]. The observed effect size phi is medium, 0.35. Cramer's V effect size is 0.24. This indicates that the magnitude of the difference between the observed data and the expected data is medium.

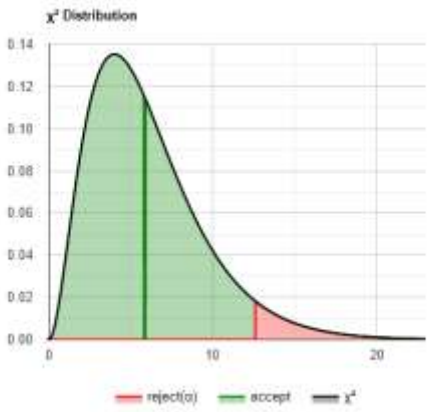
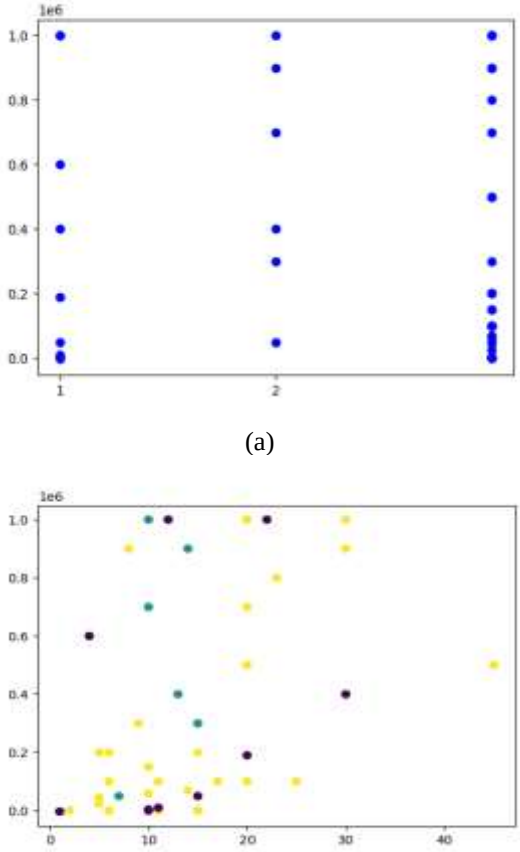



Fig. 5. $\chi^2$ distribution
Source: Own results from Field Survey, 2020.

Regarding the ML-based model implementation, a regression model was built and a model based on kNN algorithm was made. The kNN model was built also for the specific nature of the values, which group data into categories, which are conceptualized for the kNN algorithm and specifically used for these types of data processing models.
For the regression model, the results were similar to the ones related to the statistical approach. Thus, a Pearson coefficient between the training category and the profit category

equal to 0.01071065174315855 was obtained and a Pearson coefficient between the training category and profit values equal to 0.003941743741843418 was obtained, which shows a low connection between the two pairs of parameters.

For the kNN-based model, there was also taken into account the years of experience as a manager, due to the nature of the used tool, which uses raw data as train and test data and the categorisation is made using a different approach. In this matter, the data was set and the distributions presented in Figure 6a and 6b were resulted.




(a)

(b)

Fig. 6. (a) Farmers distribution based on the profit type; (b) Farm distribution based on profit and years of experience.
Source: Own design based on the obtained results.

Figure 6 (a) shows a specific distribution of the profit of the farmers based on the professional training category. 1, 2 and 3 on the horizontal axis are codifications for the three professional training categories, elementary training, exclusively practical training and complete agricultural training, respectively.

While for the category 2 the profit is not concentrated, for the other two categories the profit has a tendency of concentration for a level below 200 thousand euros.

In Figure 6 (b), the blue markers represent the farmers with exclusively practical training, the yellow ones the farmers with complete agricultural training and the purple markers represent the farmers with elementary training. As we can observe, the distribution based on profit related to the experience tends to be lower for the farmers with complete agricultural training and fewer years of experience.

Following the methodology presented in the previous section, the values presented in Table 5 were obtained, for the given values. The first instance of the implementation took into account the determination of the training category based on the profit and the experience.

Table 5. kNN implementation results for the first instance

| Farmer ID | Initial training category | Training category (k=10) | Training category (best k) |
|---|---|---|---|
| 37 | 3 | 3 | 3 |
| 1 | 1 | 3 | 3 |
| 41 | 3 | 2 | 1 |
| 13 | 3 | 3 | 3 |
| 42 | 3 | 3 | 3 |
| 14 | 3 | 3 | 3 |
| 18 | 2 | 3 | 2 |
| 8 | 3 | 3 | 3 |
| 25 | 3 | 3 | 3 |
| 40 | 1 | 3 | 3 |
| Accuracy | 1.0 | 0.6 | 0.7 |

Source: Own results.

For the given results in Table 5, the values of the accuracy indicator are presented in Figure 7.

We can observe that the best accuracy of 0.7 is obtained for a number of 9 neighbours.

The accuracy values for different values of k (first implementation) are shown in Figure 7.

The second instance took into account the determination of the profit based on the category. The values are presented in Table 6.

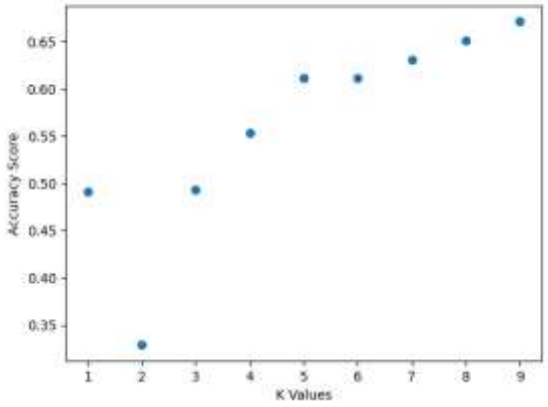



Fig. 7. Accuracy values for different values of k (first implementation)
Source: Own design based on the obtained results.

Table 6. kNN implementation results for the second instance

| Farmer ID | Initial profit | Profit (k=10) | Profit (best k) |
|---|---|---|---|
| 0 | 45 | 0.1 | 0.1 |
| 21 | 400 | 50.0 | 1,000.0 |
| 26 | 25 | 0.1 | 0.1 |
| 38 | 0 | 50.0 | 4.0 |
| 33 | 200 | 0.0 | 0.0 |
| 47 | 500 | 1,000.0 | 1,000.0 |
| 14 | 150 | 0.1 | 0.0 |
| 25 | 0 | 0.1 | 0.1 |
| 5 | 200 | 0.1 | 0.1 |
| 22 | 70 | 0.1 | 0.0 |
| Accuracy | 1.0 | 0.0 | 0.12 |

Source: Own results.

We can observe that the accuracy is quite low, which indicated the usage in the model of a categorisation of profit values instead of the profit value itself for all the instances that may be taken into account. In this matter, a categorisation of the profit was made and the results obtained for the third instance are presented in Table 7.
Also, the accuracy levels for the third instance of the implementation are presented in Figure 8.
The accuracy has a better value for a lower number of neighbours (k = 1). As we can observe, the model has given better results when the profit was categorised, in this way validating the nature of the kNN instrument and completing the comparison between the two methods for determining the relationship between the given parameters, which was not a consistent one, especially regarding the statistical approach.

Table 7. kNN implementation results for the third instance

| Farmer ID | Initial profit category | Profit category (k=10) | Profit category (best k) |
|---|---|---|---|
| 8 | 1 | 1 | 1 |
| 45 | 4 | 4 | 4 |
| 26 | 3 | 2 | 3 |
| 43 | 4 | 4 | 4 |
| 11 | 2 | 1 | 2 |
| 34 | 4 | 4 | 4 |
| 35 | 4 | 4 | 4 |
| 32 | 4 | 2 | 4 |
| 28 | 3 | 1 | 2 |
| 18 | 2 | 1 | 2 |
| Accuracy | 1.0 | 0.5 | 0.9 |

Source: Own results.

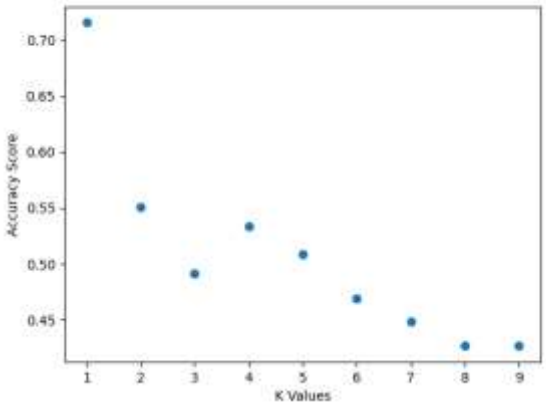



Fig. 8. Accuracy values for different values of k (third implementation)
Source: Own design based on the obtained results.

## CONCLUSIONS

The determination of a relationship between farm indicators and, in our case, between the level of farmers' training and the performance of the farm has great levels of extent, due to the complex nature of the parameters.
In this matter, the statistical method is a well-founded one in the practice and the literature, giving specific accurate results for a given set of data.
On the other hand, the determination of this relationship brings a new type of approach and can lead to significant results of the analysis from new perspectives.
For example, this paper extended the analysis capability of the ML-based method, due to the

fact that the presented ML model has given the possibility of training of the data and, therefore, the validation of new data input by the user.

Another conclusion would consist in the necessity of larger sets of data which can refine both the statistical and ML-based methods results.

As future work, the refinement would be made on the determination of a larger set of data.

Also, the comparison will be improved by modifying the ML model by introducing several new aspects, such as the categorisation of specific parameters.

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# ECONOMIC AND TECHNOLOGICAL ASPECTS REGARDING THE CULTIVATION OF BLUEBERRIES IN THE CONDITIONS OF THE REPUBLIC OF MOLDOVA

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***Abstract***

*Cultivation of blueberries is an entrepreneurial activity recently approached by local farmers, a business with a fairly high economic potential. The nutritional and economic value of this crop fuels an active interest for both consumers and local producers. However, blueberry cultivation represents a risky challenge for potential domestic producers. This fact is conditioned, mainly, by the local natural factors that are unsuitable for the development and fruiting of the blueberry, respectively, for the creation of conditions similar to the natural habitat of the blueberry, considerable investments are required. The aim of the paper is to present a series of calculations proving that blueberry cultivation represents a profitable business in Moldova. The used methodology is based on comparative, analytical methods, and financial indicators that prove the business profitability. With a thorough elaboration of the whole business process, with all the calculations and analysis of the estimated results, as well as the exact forecasting of the risks and the impact, the cultivation and production of blueberries in the conditions of our country can become a successful business.*

***Key words*****:** *blueberry culture, agricultural producers, economic value, planning, investment*

## INTRODUCTION

Until recently, blueberry culture in the Republic of Moldova was an interest only to amateur fruit growers, being cultivated in the auxiliary sector, and the non-essential harvests obtained were intended for domestic consumption. Accordingly, the majority of the population perceived bilberry berries as an exotic product. As the domestic food market began to be supplied with blueberry products (fresh, frozen, juices, jams), by exporters from Romania, Ukraine and other countries, but also the consumer information campaign regarding the benefits healing properties of blueberries, caused a special interest from the population for the given product. This fact was also noticed by domestic agricultural producers who pointed out in blueberry production an obvious economic opportunity, but also the possibility to diversify their arsenal of blueberry products offered to consumers. Traditionally, the level of fruit consumption, especially of bacifera in our country is quite high, which favors a stable demand on the domestic market for currant, raspberry, blackberry, and more recently - blueberry fruits. At the same time, the rather high price offered for a kilogram of blueberries mentions the profitability and high profitability that the cultivation of this crop can offer.

The given paper is a reflection of the evolution of the blueberry production sector in the Republic of Moldova, of the economic and technological impediments faced by the respective field. At the same time, this report is a projection of the opportunities that can benefit potential investors determined to invest in the development of blueberry culture in the geographical conditions of our country.

## MATERIALS AND METHODS

When preparing the given report, general research methods (empirical and theoretical methods) were used, the analysis of statistical data was applied, reflecting the level of production and use of blueberry orchards both globally and nationally. Primary documents represented by specialized literature (books, monographs, scientific reports and didactic

materials, etc.), as well as secondary documents (statistics by field) were used as sources for the respective report. The information provided by the National Bureau of Statistics of the Republic of Moldova and relevant international organizations was widely used.

## RESULTS AND DISCUSSIONS

Cultivation of blueberries in industrial quantities is a relatively new activity worldwide. The global demand for this product is constantly increasing, mainly due to the healthy properties attributed to the fruit. The price for blueberries is therefore high, which is why many countries see enormous potential in this crop. The countries of Eastern Europe, the Balkans and Peru are expanding their blueberry plantations every year. The area under blueberry cultivation exceeded 205,000 ha in 2020 and production is expected to continue to grow strongly in the coming years. Most of the planted area is concentrated in the two American continents, but producers in the Asia-Pacific region are catching up fast. North America, the cradle of blueberry production, continues to be a relevant region for this crop. In South America the blueberry is expanding rapidly, and new areas are being developed in Europe, Africa and Asia [2].

Currently, the main producers and exporters of blueberries in Europe are Spain and Morocco, being also the main suppliers on the German markets. The price of blueberries on the market varies between 0.80 and 1.20 euros for 125 gr. of product, and the average price on European markets for a ton of blueberries is approximately 2,300 - 2,500 euros. As a comparison, the price of this product in stores and on agricultural markets in the Republic of Moldova is 6-10 euros/kg, depending on the condition of the product sold (fresh or frozen).

In line with other Eastern European countries, Ukraine is constantly expanding its berry production. Blueberries are one of the most popular products for new plantations in the country, and the export volume varies between 4,500 and 5,000 tons. Most exports go to Poland, Turkey, France and Belarus. Serbia exports mainly to its region, to Western Europe, Turkey and Russia. The Middle East is also growing as an export market, especially the Gulf countries.

In Italy, the blueberry harvest begins at the end of March in the south of the country and ends at the beginning of September in the northern regions. The demand for blueberries is increasing every year. Compared to last year, it has increased by about 60% in southern Italy. Production is constantly increasing due to technological innovation and the introduction of new varieties. The international network of berry producers *Berryway*, has launched a project to establish a production chain to unite the different Italian territories, to supply fruits 12 months a year [4].

China is the leader in blueberry consumption in Asia due to the growth of its local supply, but also massive imports. Currently the blueberry market is changing: the center of gravity is moving from North America to various regions of the globe. As the market becomes more competitive and consumers more demanding, fruit quality is vital to take advantage of growth opportunities [10].

Romania has over 300 blueberry growers and an estimated annual production between 23,000 and 30,000 tons, this niche developing rapidly in recent years due to the high demand for these products and access to European funds for the establishment of such cultures.

As mentioned, the top seven blueberry exporting countries - Peru, Chile, Mexico, USA, South Africa, Poland and Canada - secured the world market with a volume of blueberries worth $2.1 billion in 2019. If the external deliveries of these countries will increase by an average of 5% annually then, in the next 5 years, the global exports of blueberries until 2025 will be almost 3 billion dollars. This trend is noted by the fact that the decrease in global blueberry exports has not occurred since at least 2010 and in the period 2015-2019 the annual increase in deliveries was on average 46 thousand tons.

Between 2010 and 2019, world blueberry production increased from 439 thousand tons to 1 million tons. During this time, the number of countries growing blueberries

increased from 26 to 30, while 27 countries saw an increase in the blueberry harvest. Since 2012, the number of countries that annually grow at least 10 thousand tons of blueberries is constantly increasing, and by 2019 at least 11 countries have exceeded this threshold. A rapid increase in yield was observed in Peru, where 125 thousand tons of blueberries were already harvested in 2019 [12].

Blueberry consumers in the Republic of Moldova managed to make significant savings in 2022 when purchasing these extremely healthy berries. If in previous years the market was mainly controlled by two local producers, and wholesale prices for blueberries were 12.5 euros, then 9 euros per kilogram, last summer blueberries were sold at retail prices of 6-7 euros per kilogram cranberries. This is largely due to imports from Ukraine. Ukrainian agricultural producers, despite the war, increased the export of blueberries by 1.5 times in 2022, which led to the collapse of prices for this product in Moldova. At the same time, the total export of fresh blueberries from Ukraine in 2022 exceeded 2.5 thousand tons, increasing by one and a half times compared to 2021. Other important importers of blueberries from Ukraine - the Netherlands, the United Kingdom and Moldova - have suddenly increased import volumes: by 80%, 68% and 2.4 times, respectively. In addition, illegal deliveries with uncontrolled sales in the bazaar should be taken into account in Moldova, which greatly complicates the life of local farmers [11].

Currently, 14 ha of blueberries are registered in the Republic of Moldova, and the global harvest from this area in 2020 was approximately 21 tons. The largest blueberry plantation, approximately 10 ha, is found in the Nisporeni district.

The rest of the plantations have insignificant areas or the given crop is grown on the auxiliary sector, and the production obtained is intended for domestic consumption. The respective situation reveals the fact that blueberry cultivation in the Republic of Moldova is an underutilized niche, with a huge potential that is yet to be exploited at its true value.

Photo 1. The first blueberry production obtained in the Republic of Moldova in 2016
Source: Canal 3, MD, 29 IUNIE 2016, A tasty business, The first harvest of blueberry in the Republic of Moldova [3].

The specific pedological and climatic requirements of the blueberry entail a high degree of difficulty in its cultivation in the conditions of the Republic of Moldova. Due to the natural distribution area - mountain areas with coniferous forests - cultivated blueberries bear fruit only on strongly acidic soils. Thus, in the conditions of our country where soils with a neutral or weakly alkaline or weakly basic PH prevail, the blueberry plant can develop but the flowers do not form the fruit. In order to create the optimal conditions for the growth and fruiting of this crop, it is necessary to create conditions similar to the original habitat or to modify the soil reaction to a PH of 3.0 - 3.5. This fact, in addition to the necessary technological operations, involves significant expenses and large investments in soil adjustment, water supply, etc.

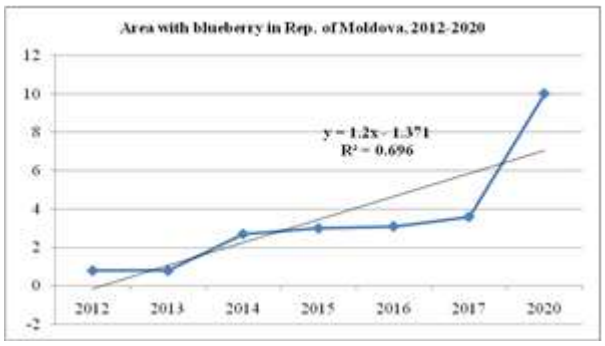


Fig. 1. Area with blueberry in Rep. of Moldova
Source: Own design and calculation based on the data from [13].

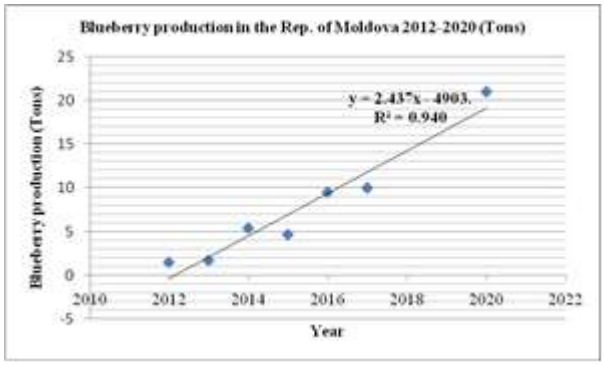


Fig. 2. Blueberry production in the Rep. of Moldova, 2012-2020 (Tons)
Source: Own calculation and design based on the data from [13].

As a result, domestic blueberry prices are directly influenced by three important aspects: the high cost of production, small production areas and the less favorable conditions for the given crop.

In the given context, the establishment and exploitation of a blueberry plantation in the conditions of the Republic of Moldova requires the use of a huge volume of financial resources.

They can be obtained by attracting investments from various state or private investment sources. In order to obtain the given resources, the manufacturer is obliged to implement an extensive investment process consisting of a series of stages.

The given phases represent a sequence of activities carried out in a well-determined order with the aim of designing and achieving an efficient management of financial and production resources.

The stages of the investment process involved in an entrepreneurial activity based on the production of blueberries are the following:

The concept of the idea - the future entrepreneur analyzes a wide spectrum of economic activities or fields of activity in which he could manifest himself most effectively, studies the market, the level of competition in the given segment, analyzes his technical and material capacity to initiate and develop the given business.

This phase, as a rule, does not require significant financial investments, and its success depends on the analytical capabilities of the potential entrepreneur.

The given principle is also valid for the future blueberry producer. Initially, the market and ways of making blueberries will be studied, the level of market saturation with the respective product, the current and potential competitors that may appear on the given market will be determined, an attempt will be made to identify other markets for making.

Next, the technical-material capacities of the decision-maker will be established, it will determine the size of the plantation surface to be established and exploited.

Business planning and initiation - is one of the most important phases in the entrepreneurial sphere and includes two sides: the organizational-legal phase and the technical-financial side.

The organizational-legal part is reflected in the previous subchapter. Technical-material planning aims to determine and efficiently use the available technical, technological and workforce resources.

Depending on the level and capabilities of insurance with these factors, the basic constituent of the business is determined - the financial or investment component.

The prosperity of a successful entrepreneurial activity is directly proportional to the entrepreneur's ability to effectively attract and manage available financial resources.

Thus, financial management persists in all stages of the company's development - starting with its foundation and ending with its liquidation.

Given the fact that the production of blueberries involves a long process that includes a time interval that can exceed 25-30 years, the investment management is very complex. This fact is due to the need for considerable financial resources in the phase of establishing the plantation, the period of maintenance of the plantation until it bears fruit, as well as the time interval characterized by the maintenance and obtaining the expected production.

The formation stage – the period of business initiation where various grants, personal savings, personal credit, subsidies, fixed capital represent investment sources.

For the respective business, this stage requires the largest volume of investments. This fact is

explained by very high consumption consisting of: expenses for the design of the plantation;
the cost of planting material, the large volume of technological works applied to the establishment of the plantation; expenses incurred for the design, procurement and installation of the irrigation system.
Growth stage – the period of growth of the household, characterized by the procurement of the necessary equipment, planning, analysis, development and promotion of the marketing plan. During this period, such investment sources as: free cash flow, commercial loans, accrued interest, bank loans, leasing, venture capital and different financial assistance are used.
For the blueberry household, this period ranges from the first year of maintenance to the 10-12th growing year, when the blueberry crop begins to yield more uniform yields.
Maturity stage – the enterprise expands, enters new markets, diversifies products and innovates. Such investment sources as: risk capital, capital markets, dividends are used.
It is the period when the household obtains maximum harvests with optimal expenses, it can be an opportune stage to expand the area of the plantation, the implementation of new more efficient technologies, the procurement of production processing lines to diversify the form and content of blueberry products which would lead to an increase in value their additions. It is a beneficial period for increasing and streamlining the product value chain.
Decline stage – the enterprise restricts its activity, liquidates or reorganizes its activity.
It coincides with the period when the volume of the blueberry harvest starts to decrease, respectively and the income decreases. At this stage, free cash flow, other sources of investment are used [6].
About 85% of the agricultural budget is intended for agricultural producers (subsidies, premiums, direct payments for the production of goods, transfers, investments, etc.) aiming at the operation of the agricultural market, the increase of incomes and on this basis the provision of sources of financing for production and investments.
Agricultural credit is not a substitute for subsidies, but harmonizes with the system of supporting agricultural producers through the use of subsidies that ensure the necessary resources for the value of investments, the development of the production process and the sale of products.
The main mechanism for agricultural and rural development must become credit. In this way, the most important financial resources can be mobilized. The development of credit does not eliminate subsidies for rural development, but is harmonized in order to form a profitable business.
Credit plays a decisive role in the normal functioning of the market, in the concentration of small capitals and the financing of investment objectives. That is why internationally accepted agricultural policies and financing mechanisms based on available natural resources and institutional structures are needed.
Currently, the main agricultural lending institutions are banks and microcredit organizations that provide farmers with a wide range of products.
The offer involves granting both short-term loans (which cannot exceed 12 months), medium-term loans (with a repayment period of 1-5 years) and long-term loans (with a repayment period of more than five years).
Rural financial markets have not expanded due to the poor performance of the private sector and the low volume of credit ceilings for investments secured by the banking system.
Although the number of rural depositors is high, the supply of credit in this environment is weak and the number of credit transactions is low. Credit for investment in agriculture is limited not only by bank resources, but also by the ability of applicants to develop the investment project.
With the determination of the forms of financing, approval of the most effective method of financial management, the blueberry producer moves to the production stage where the implementation and observance of modern production technologies has a decisive role.

Taking into account the fact that the conditions for the development of blueberries in the geographical area of the Republic of Moldova differ from those authentic to the given culture, the blueberry grown here is more strongly attacked by a series of specific and non-specific pathogens and pests.

Moreover, the expansion of the spread area of the given culture is also accompanied by an increase in the incidence of pathogens and pests. Entrepreneurial activity entails a certain risk, materialized through financial losses.

Forecasting and objective assessment of potential danger situations requires a special approach to these problems.

Therefore, the identification of risks, the assessment of potential damage and the establishment of methods to combat this phenomenon must be carried out before starting the business.

Currently, the domestic agricultural sector is the field with the greatest exposure to risk conditions, being determined by social, economic, political factors and last but not least – unfavorable climatic conditions.

As a result, the entrepreneurial activity in the given sector is constantly under the pressure of these elements which, in turn, are distributed in the following way:

a. Production risks;
b. Market and price risks;
c. Business and financial risks;
d. Technological risks;
e. Accidental risks;
f. Social risks;
g. Human risks;
h. Political risks [7].

As measures to combat these situations, it is the implementation and observance of scientifically proven production technologies, the appropriate provision of the technical - material base according to the technological requirements in force, the full observance of the requirements related to the establishment of the plantation, the geographical location, the quality of the soil and water for irrigation, cultivation of blueberry varieties approved for our conditions

## CONCLUSIONS

The cultivation of blueberries in the Republic of Moldova is a new occupation, respectively, and the final product - blueberry fruits are little known to the domestic consumer. But, thanks to active promotion through all means of information, this product is increasingly making its way into the list of preferences of the local population.

The natural habitat of blueberry crops are mountainous geographical areas, where soils with a strongly acidic reaction predominate. Given the fact that most soils in the Republic of Moldova have a neutral reaction, with non-essential deviations, it is necessary to artificially create optimal conditions, defined by the formation and maintenance of the chemical composition of the soil substrate corresponding to the beneficial development of the root system. This fact requires substantial investments both for the procurement of the necessary material (peat, conifer bark) and for the maintenance work to be carried out annually. This fact requires the future producer to initially carry out a relevant analysis of his capabilities to correctly and objectively determine the necessary resources, as well as to identify the sources and methods of attracting the necessary investments.

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# TRENDS IN THE DEVELOPMENT OF INNOVATIVE PROCESSES IN THE INDUSTRY OF THE AGRO-FOOD COMPLEX OF RUSSIA

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***Abstract***

*Sustainable development of the production potential of the agro-food complex is inextricably linked with the introduction of innovative methods and approaches to production. The purpose of the article is to develop theoretical and methodological approaches to the study of sectoral features of the innovative development of production potential. The analysis carried out revealed significant differences in the level of innovative development of agricultural sectors. The study applied the method of normalizing resource intensity indicators in relation to threshold values, which made it possible to determine the degree of innovativeness of the components of the resource potential. The efficiency of costs for innovation activity is calculated, it is revealed that the lowest cost efficiency is typical for dairy cattle breeding and grain production. To identify trends in intersectoral innovative development, the article uses SWOT analysis tools. A matrix of innovative development of Russian regions has been developed on the example of the dairy cattle breeding industry, which reflects the degree of contribution of resources to the dynamics of the production of innovative products. This approach is aimed at determining the optimal values of resources to achieve sustainable innovative development of the sectors of the agro-food complex.*

***Key words*****:** *trends, sustainability, innovations, agro-food complex, industry development, rationing method, SWOT analysis, efficiency*

## INTRODUCTION

In modern conditions of functioning, the sustainable development of the agro-food complex on an innovative basis is a vector for ensuring the food independence of countries. One of the conditions for achieving sustainable socio-economic growth is the intensive introduction of advanced scientific achievements both at the regional and sectoral levels. However, the process of transferring innovations at different levels of management has its own specifics and justifies the need to develop differentiated approaches to management.

Works devoted to the study of sustainable growth of agriculture in various countries [2, 10, 23]. issues of ensuring food security and food independence are analyzed in the works [6, 11, 15]. Description of approaches to state support for agriculture are analyzed in various research papers [27]. Reiff [21]conducted an analysis of differentiated differences in agricultural production on the example of the European Union based on data from the World Bank. Using the Ward's method, countries were classified into six different groups and marked differences in agricultural productivity were shown. The research[9]is devoted to the analysis of differences in production resources - labor, land, capital for agricultural sectors in the European Union. In addition to the Ward method, this work used the DEA method and ANOVA analysis to assess the significance ofdifferentiated differences in the economic and technological efficiency of large agricultural enterprises in the EU countries.Trends in sustainable development of both agriculture in general and production factors are studied in the work of Magrini [4, 13] using Eurostat statistics for the period since 2006.

This study revealed the relationship between subsidies and production growth in specific

agricultural sectors. Studies on the problems of increasing competitiveness, profitability and economic growth based on the improvement of subsidiary support are presented in the works [1, 14].

In the agro-food complex, innovative processes have their own characteristic features associated with the specifics of agricultural production. The most striking features include geographic, natural and climatic factors, seasonality of production, mixing of technological processes with natural ones, a low degree of integration of scientific achievements into the production sector, a lack of competencies demanded by the digital economy, low demand for innovations and high technology products, imperfection mechanism for the introduction and transfer of innovative technologies and advanced scientific achievements to agricultural producers [3, 16].

First of all, attention is drawn to the continued diversity of agriculture, which is especially noticeable in the low-concentration production of potatoes and vegetables. On the contrary, in grain production and pig breeding, the dominance of agricultural organizations predetermines a rather high level of production concentration [8].

The share of the ten largest companies in the total volume of industrial pork production in the Russian Federation amounted to about 60% in 2021 [20].

The purpose of this work is to assess the industry-specific features of the process of introducing innovations, to substantiate differentiated approaches to managing innovation activities at the industry level using the example of dairy cattle breeding using SWOT analysis tools.

## MATERIALS AND METHODS

The methodological basis of the study was state legislative acts, government decrees and decisions, scientific works of domestic and foreign scientists - economists and agricultural specialists on the problem under study.

In the course of the study, monographic, abstract-logical, analytical, economic-statistical, expert research methods were used. Legal and regulatory acts, information from Rosstat, National Research University Higher School of Economics, the Ministry of Agriculture of the Russian Federation, the Deloitte Research Center, as well as regulatory documents and materials from scientific literature and periodicals were used as the information base for the study.

## RESULTS AND DISCUSSIONS

A study of innovation and research activities at the intersectoral level was carried out. Agriculture lags far behind the average level in the economy in terms of innovation activity (Figs. 1 and 2).

The cumulative level of innovative activity as of 2019 was at the level of 4.8% in crop production and 4.0% in animal husbandry. The innovative activity of organizations in industrial production was more than 3 times higher and amounted to 15.1%.

In the structure of costs for technological innovations, more than half falls on the purchase of machinery and equipment. Also, a significant share falls on engineering, and the indicator in agriculture is 2.7% higher than in industrial production.

One of the main factors in the growth of innovative activity belongs to research activities (Fig. 3).

Research and development at the end of 2019 amounted to 24.6% of the total cost of technological innovation. This indicator shows a low level of susceptibility of agricultural producers to the implementation of the results of research activities in agricultural production.

The imperfection of the mechanism of interaction between the participants in the innovation process hinders the implementation of the results of scientific and innovative activities in agricultural production. Technological exchange processes, due to the low level of innovative activity of enterprises, do not play a priority role in increasing the volume of agricultural production. The involvement of organizations in innovation processes is characterized by low congruence, which is confirmed by the

indicators of the readiness rating of Russian regions for the introduction of digital technologies in agriculture. The group of regions with a high degree of readiness includes subjects of the Russian Federation with a good technological base, an appropriate level of training of specialists in agriculture (Krasnodar Territory, Novosibirsk Region, Republic of Bashkortostan, as well as Belgorod, Voronezh, Nizhny Novgorod, Novosibirsk, Tambov, ChelyabinskRegions. In the regions This group has developed and operates programs to support the introduction of new technologies in agriculture, digital technologies are widely used.However, in the vast majority of Russian regions, the necessary conditions for the introduction of digital agriculture technologies have not yet been created [24].

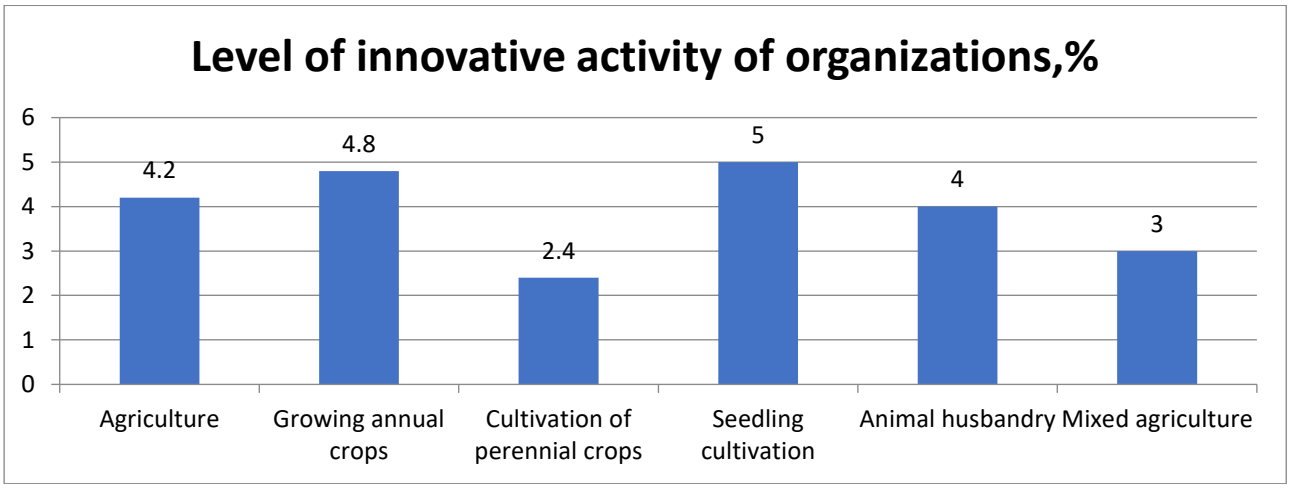


Fig. 1. Intersectoral differentiation of innovative activity of agricultural organizations in Russia in 2019 Source: Own calculations based on data [7].

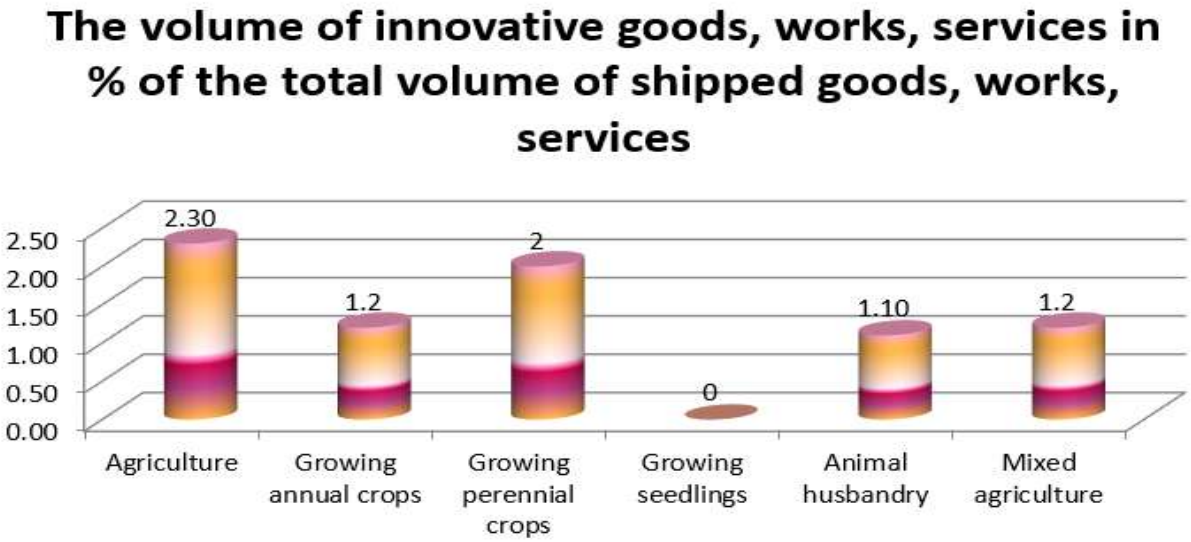


Fig. 2. Intersectoral differentiation in the production of innovative products in 2019
Source: Own calculations based on data [7].

The innovative activity of the organizations of the agro-food complex is not high enough, and the efficiency of organizations' costs for innovative activities (calculated as the ratio of the cost of shipped innovative goods of their own production, works and services performed to the costs of organizations for innovative activities) has significant industry differences (Fig. 4).

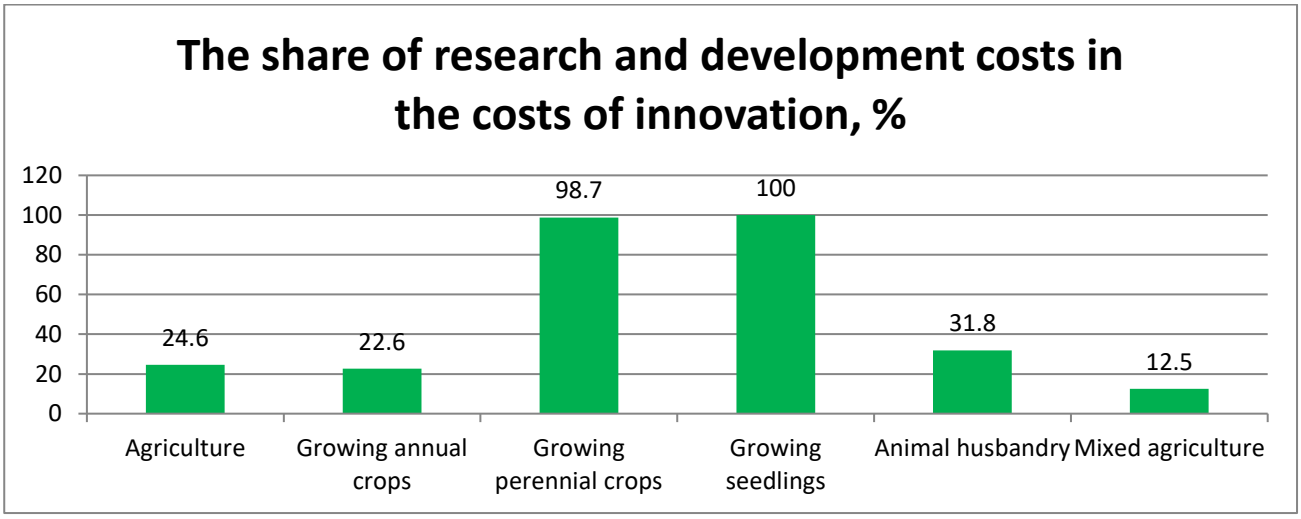


Fig. 3. Intersectoral differentiation of research activities in agriculture 2019
Source: Own calculations based on data [7].

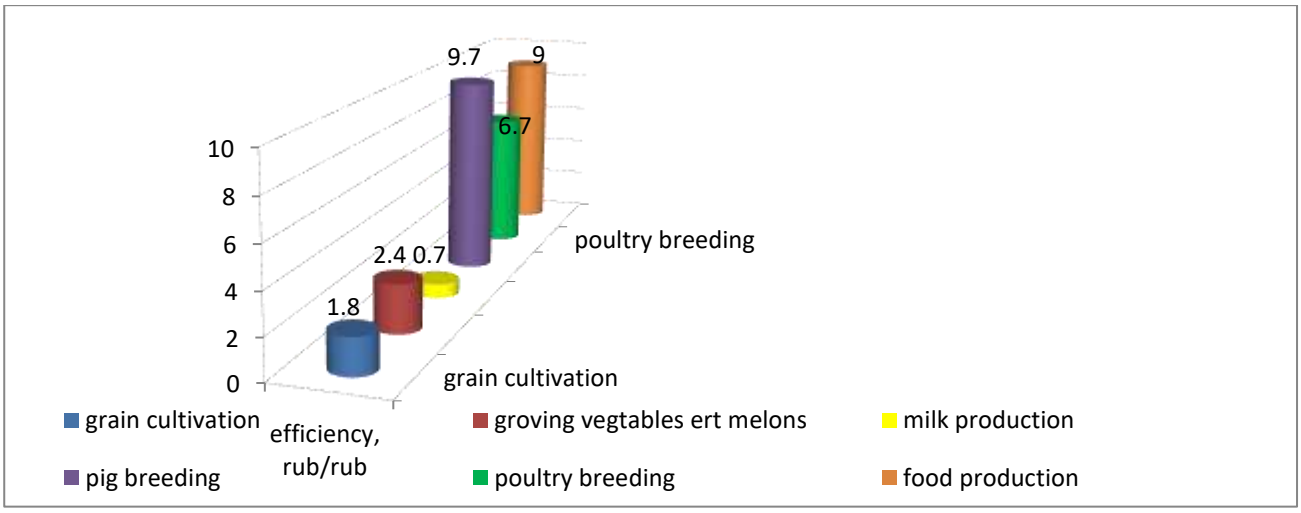


Fig. 4. Cost effectiveness of organizations for innovative activities, rub/rub. 2021
Source: Own calculations based on data [7].

The lowest cost efficiency for innovation activities is typical for dairy cattle breeding (0.7 rubles) and grain production (1.8 rubles). In animal husbandry, the highest cost-effectiveness for innovative activities was achieved in pig breeding (9.7 rubles), slightly exceeding the same indicator for the type of activity "Production of food products" (9.0 rubles).

Identification of the priority factors of innovation activity will significantly improve the efficiency of managing innovation processes in the agro-food complex. In this study, SWOT analysis tools were used to identify trends in intersectoral innovative development

The results of the analysis using the SWOT-analysis tools made it possible to identify the factors of innovative development in various types of agricultural production. The main advantage of cultivating grain crops and vegetables is the availability of both necessary and sufficient land resources. In grain production, industrial biotechnologies are widely used, deep processing of grain is carried out. The development of deep processing as one of the most important areas of innovation predetermines the innovative diversification of grain exports. [22].

At the same time, the low cost effectiveness of innovation activities and the low share of costs for technological innovation in the total volume of shipped goods are significant limiting factors for the innovative development of grain and vegetable production. The lack of a full-fledged base of

developments in the field of breeding and seed production, including those for specific crops, also hinders innovative processes. A large role in strengthening the innovative dominant of crop production is given to expanding the network of innovation and technology centers, business incubators and techno-policiesin order to develop fundamentally new technologies and varieties of grain, vegetable and melon crops with high yields and resistance to adverse factors. One of the promising forms of organizing greenhouse vegetable growing is the creation of completely closed facilities with continuous production, which is especially important for regions with unfavorable natural and climatic conditions.

The most important direction in the innovative development of animal husbandry is the formation of a competitive domestic breeding base, associated with the use of technologies for genomic selection and genomic evaluation of animals.

In animal husbandry, there are significant intersectoral differences in innovation activity. For example, in dairy cattle breeding, due to the heterogeneous institutional environment, regional and intra-industry differentiation of technological modernization can be traced: about 60% of milk is produced according to modern technological standards, while in poultry farming this figure is 65-70%; in industrial pig breeding - 85-90%. In large pig breeding companies, the costs of feed, labor, and electricity correspond to world standards [12].

It should be noted that due to the increase in the payback period of projects, the costs of innovation activities have a multidirectional effect on achieving compliance with modern technological parameters.

According to a sample survey of the results of innovation activities conducted by Rosstat in 2021, the most noticeable impact of innovations on modernization processes was observed in 38% of poultry enterprises and 20% of dairy cattle breeding enterprises. The lack of influence of innovations on the development of modernization and technological re-equipment was noted by representatives 41% grain farms, 21% pig farms and 25% vegetable farms.

The point effect of scale generates the level of costs and product quality in large enterprises with higher innovative activity, and therefore the introduction of digital technologies is especially important for small enterprises. A steady trend of low innovative development in the small-scale commodity economy is also characteristic of individual Eastern European countries [19].

The current institutional structure of dairy cattle breeding predetermines a lower level of use of innovative potential compared to other industries. Previous studies have proposed methodological approaches to assessing the innovativeness of individual resource components, according to which the level of innovativeness of feed costs in dairy cattle breeding is 70%, and fuel costs - 35%; in pig breeding - respectively 92% and 77%. In poultry farming, the innovativeness of feed reaches 90%, and the cost of electricity - 78% [26].

A promising direction of innovative development is the precision animal husbandry system based on the use of sensor technology, robotics and artificial intelligence. According to experts of the Russian dairy market, automated systems for organizing the production process provide an increase in milk yield by 30–40% [5], and the costs of individual production resources will decrease by 2.5–4 times [17].

Thus, in the medium term, digital technologies will actively influence the processes of innovative transformation of agricultural production. In the future, new digital ecosystems will be used to calculate the economic efficiency of implemented solutions and optimize the implementation process itself, as well as increase the efficiency of interaction between the stakeholders of the innovation process [18]. The paper proposes recommendations for improving the efficiency of state regulation based on the diversification of production in grain production and vegetable growing.

In the short term, in order to increase the share of high value-added products, it is planned to invest in the construction of facilities for the

storage and processing of agricultural raw materials; as well as modern wholesale distribution centers.

The formation of the innovative potential of vegetable growing, including the production of their specific types, is largely determined by the mechanisms for stimulating the innovative susceptibility of organizations to introduce innovations at all stages of the innovation process [25].

Subsidizing the reimbursement of part of the costs for the creation and modernization of facilities remains a necessary instrument of state regulation, which is especially important for the greenhouse industry.

The prospects for increasing the gross value added in agriculture are associated with technical and technological modernization, changes in the field of breeding and seed production. The creation of a domestic cross-country of meat chickens will reduce the dependence on imports of poultry genetic resources by 25-30%.

On the example of dairy cattle breeding, methodological approaches have beendeveloped to assess the impact of innovative support on the innovative potential of milk production and processing in the regional context (Table 1).

Table 1. Matrix of regional innovative potential of milk production and processing and innovative support (2020)

| The level of the innovative potential of milk production and processing | Level of provision with resources for innovation support | | |
|---|---|---|---|
| | High | Middle | Low |
| High | Regions-leaders of the dairy market with a high return on innovative subsidies. Typicalregion: Belgorodregion. | Regions of sustainable growth - with a fairly high return on innovative subsidies. Typicalregion: Kurskregion | Regions with low innovation subsidies and high innovation potential of milk through the introduction of digital platforms. . Typical region: Novosibirsk region. |
| Middle | Regions of potential growth in milk production due to the introduction of innovative technologies by large agricultural enterprises. Typicalregion: Vladimir region. | Regions that actively use innovative technologies that have the opportunity to increase the production potential of milk. Typicalregion: Kalugaregion | Regions with low innovation subsidies and limited opportunities to increase innovative production potential due to unfavorable natural and climatic conditions. Typicalregion: Amur, region. |
| Low | Regions with a low return on innovative subsidies and a weak position in the dairy market. Typicalregion: Pskovregion | Regions with a low return on innovative subsidies due to the predominance of small-scale milk production. Typicalregion: Volgogradregion | Regions with weak positions in the milk market with low innovative production potential and underfunding of innovations. Typicalregion: Astrakhanregion. |

Source: Own calculations.

The processing depth indicator was calculated as the share of cheeses, butter and milk powder in the volume of manufactured products. Innovative support resources are proposed to be calculated as the sum of the ranged values of subsidies for reimbursement of costs for the modernization and support of breeding stock. In the development of these provisions, an innovation matrix was developed, built according to the principles of ranking groups of regions according to innovative support resources and the

innovative potential of milk production and processing.

Such a methodological approach makes it possible to identify the degree of sufficiency of innovative support resources to improve the efficiency of using the production potential of milk production and processing, as well as to justify the necessary measures to stimulate the introduction and use of innovations.

## CONCLUSIONS

Thus, the article highlights the priority areas of innovative development aimed at increasing the added value. In order to improve approaches to management and in-depth study of industry differences, a SWOT analysis toolkit was proposed and the cost efficiency of organizations for innovative activities was calculated.

The matrix of innovativeness has been developed, which makes it possible to identify groups of regions according to the ratio of the contribution of resources to the growth of the value added of innovative production. The results of this study will allow more targeted and accurate development of the directions of state support for the development of innovation and increase the efficiency of production potential on the example of the dairy cattle breeding industry.

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# DIGITALIZATION OF AGRICULTURE IN BULGARIA

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***Abstract***

*A certain increase in the scope and degree of digitalization and digitization in the agricultural sector has been laid down in the EU and national strategic documents, for the new programming period of 2023-2027. This explains the intention to increase competitiveness and ensure a higher return on investment through the accumulation of new knowledge and innovation. Therefore, the study aims to analyze the current state and subsequent development of digitalization of the agricultural sector in Bulgaria. The applied research methods in the present study are theoretical and empirical, including: analysis, synthesis, comparison, and statistical processing. As a result of the conducted research, it was found that in recent years there has been a positive tendency in the accessibility of Bulgarian households to the Internet. However, significant differences have been reported regarding digital technologies in Bulgarian agriculture, compared to other members of the EU. As a result of the results obtained, a review of the strategic and planning documents has been accomplished, in order to support the interested parties in the preparation and improvement of policy-making in this sector.*

***Key words*****:** *digitalisation, agriculture, rural areas, Bulgaria*

## INTRODUCTION

Agriculture is a hot spot in a series of global trends that are changing at a rapid pace. The process of restructuring the ecosystem requires a review of the priorities and the operating model that can meet current challenges. Agriculture continues to play a key role in a dynamically developing world, faced with searching for important solutions related to implementing sustainable measures to deal with food insecurity and environmental issues. It is evident that changes are taking place with the latest updates to regulatory frameworks and policies, such as the modifications made to the Common Agricultural Policy (CAP) in the EU.

As an EU member state, Bulgaria has established traditions in the agricultural sector. One of its branches - agribusiness - currently faces serious challenges related to innovation and digital transformation of agriculture. It, for its part, along with rural areas and farmers, is decisive in launching digitalization reforms and attempting modernization. The sector has an opportunity to benefit from technological advancements and address the latest European and national priorities. At the same time, it is also an opportunity for the restructuring of agro-food chains at the global and regional level. Digitalization allows the agrarian economy to become and establish itself as a highly competitive industry, comparable to other high-tech spheres of the economy. The result of this process is ensuring a higher return on investment, through knowledge and innovation, by increasing productivity, adding value, and improving quality and safety ("Strategy for the digitization of agriculture and rural areas of the Republic of Bulgaria, 2019") [15].

The Recovery and Resilience Plan, pays special attention to the agriculture sector and sets the goal to ultimately digitize agriculture. Activities are being carried out for the preparation of an electronic information system in agriculture, which will comprise several modules. The planned resources amount to "23.9 million BGN (19.9 million BGN at the expense of the Recovery and Sustainability Mechanism and 3.9 million BGN national co-financing) with an implementation period of 2022-2025" (NPRS, 2022) [10].

In this context, the purpose of the paper is to to analyze the current state and subsequent

development of digitalization of the agricultural sector in Bulgaria.

## MATERIALS AND METHODS

In this study, we used both theoretical and empirical research methods, such as analysis, synthesis, comparison, survey, and statistical processing.

The literature review consists of scientific studies related to the digitalization of agriculture, as well as strategic and planning documents from both the EU and national levels.

The study is based on a mathematical approach and analysis in the processing of statistical information by the National Statistical Institute (NSI) [11].

The applied methods are used to investigate the state and degree of digitalization in the agricultural industry, and identify the reasons and possibilities for dealing with the current situation.

For the purposes of this paper, it is necessary to specify two concepts, very often used synonymously. "Digitization is the process of transforming information from a physical format into a digital version. While digitalization is the very practice of using digital technologies to improve corporate processes" (Iliev, 2022) [6].

## RESULTS AND DISCUSSIONS

Under the conditions of exceptional development of technologies, sectors, which are traditional for Bulgaria, such as agriculture and animal husbandry, also called low-tech, are becoming a testing ground for a number of top technological achievements. An example of such technologies are the implementation of biotechnology, autonomous robotic systems, artificial intelligence, cloud technologies, etc. These are only part of the modern approaches necessary to increase the productivity of crops, reduce the consumption of resources and reduce negative impacts on the environment.

Some authors (Klerkx et al., 2019) [7] consider digitalization and the socio-technical process of implementing digital innovations as a mass phenomenon and an undeniably highly widespread trend. Undoubtedly, in recent decades, work has been carried out in many diverse scientific fields, key to successful and high-productivity agriculture, both at the global and national level. They address both digital transformation, and the need for the correct application of knowledge and experience in this area.

Kovács and Husti defend the claim that agriculture can significantly increase its efficiency and competitiveness by using the advantages of digitalization. "Smart farming makes use of GPS services, machine to machine (M2M) and Internet of Things (IoT) technologies, sensors and big data to optimize crop yield sand reduce waste" (Kovács & Husti, 2018) [9].

Researchers in the field add that "smart agriculture is transforming the agricultural sector in terms of economic, social, and environmental sustainability" (Ciruela-Lorenzo et al., 2020) [2]. Understanding new technologies like robotics and drones can be better grasped by considering the example of Spain, as explained by the authors. They support the view that "digitalization is imperative for companies nowadays".

Keeping to traditional ways has already led to lagging production growth, market loss, crowding out by competitors, as well as backward and inefficient working practices. Activities must be diversified, and new technologies introduced, while operating in symbiosis to guarantee the sustainability of production growth.

The first step is to measure the level of digitalization of a given company through a developed digital diagnostic tool. This will give us an idea of the need for improvements in the company. Clarity regarding the degree of digitalization in cooperatives, together with the application of the organizational approach and, above all placing the person at the center of the structure can ensure the social vision of new technologies.

New horizons are emerging for labor and workforce development within digital economy, along with any challenges that arise from these perspectives. In the context of the future organization of employment, one more

aspect of digital economy should be noted - artificial intelligence. Its implementation and development bring along a number of positive and negative consequences, related to the labor market and employment. The main concern of the mass introduction of artificial intelligence is the elimination of the need for the physical factor (with this replacing the functions of highly qualified staff) and the associated generation of unemployment. At the same time, it is indicated that artificial intelligence can very successfully perform functions that are dangerous, dirty, in hard-to-reach places. It is also mentioned that these activities usually represent only a part of the work that a given laborer performs within the range of their profession. The need for a similar type of job is imperative for faster, better quality, more painless performance of a certain type of economic activity, which would normally take more time for humans on the labor market. Although facing partial automation, people are not threatened by complete automation in their jobs. For the successful, beneficial use of this kind of new technologies, it is necessary to make efforts and conduct trainings in the direction of reorientation of labor, increasing the digital qualification of workers with the aim of a better symbiosis between man and machine. Without denying the danger that some activities or even professions may disappear, new, different and yet unknown ones are likely to emerge, of unpredictable numbers and nature, as well as hazards, related to restructuring the economic process.

In this sense, there are researchers who (Valvis et al., 2020) [17] claim that "The global market for AI in Agriculture is valued at 240 million USD in 2017 and is expected to reach 790 million USD by the end of 2023, growing at a CAGR of 21.8%". Technological advancements and AI (artificial intelligence) are already well accepted in the industry. It is believed that this is an appropriate way to ensure the possibility of using technology in agriculture to solve a number of problems, encountered in the industry, some of which are shortage of manpower, lack of space, accuracy of forecasting, waste management and production.

Agriculture plays a crucial role in addressing food security challenges and is considered one of the most important sectors from a strategic standpoint. Authors in the field point out that as a result of the exponential growth of the population worldwide in recent years, it is necessary to find a way to deal with the food problem. The proposed solution is to move from traditional agricultural methods to smart agricultural practices, also known as Agriculture 4.0. (Abbasi et al., 2022) [1].

Other authors report that the significant impacts have a socio-economic character. They refer to this phenomenon as "replacement of manual work and the possibility to leverage economies of scale". These factors benefit workers' well-being and their improved technical skills, however, they lead to a loss of practical experience due to overreliance on technology (Ferrari et al., 2022) [5]. The same study mentions that the owners of large enterprises and institutions benefit the most from this digital transformation, which has a positive impact on them. The digitalization of agriculture will also optimize the employment of agricultural workers, which may have negative consequences for SMEs and manual workers who will become redundant.

Digitalization is the process in which modern communication technologies get more and more intertwined in public life. The essence of this process is the possibility, through the digital coding of information arrays, that they can be transferred, classified, processed, stored and used easily at a minimal cost and loss. This provides a chance not only for the discovery of new, previously unknown sides of work reality, and the formation of new economic branches and opportunities, but also for much more complete and, most importantly, systematic knowledge.

Based on the literature review, two key points can be noted. First of all, there are undeniable benefits of implementing digital innovations as a mass phenomenon and positive economic consequences. Furthermore, emphasis is also placed on the negative sides of the digitalization of the sector, namely to clearly outline the level of unemployment risk for those employed in SMEs.

As for the degree of digitalization of the agricultural sector in Bulgaria, Kostadinova makes a retrospective analysis of the development of digital agriculture in Bulgaria. The author claims that the beginning was marked with the introduction of new technologies such as "ground sensors, satellite imagery, GPS receivers in agricultural machinery, etc." (Kostadinova, 2021) [8].

Nikolov et al. investigate what methods in the overall concept should be used to implement digital innovations in the field of agriculture, emphasizing the main challenges for building a sustainable model and increasing competitiveness in the sector. The authors claim that "despite the mass production of the necessary hardware, it is still an expensive and inaccessible technology, especially for the small farmer; digitalization requires specific skills on the part of the farmer (especially older and conservative farmers) to help them make use of these digital technologies; the wide variety of digital solutions confuses the user and generates additional costs from hidden fees for the use of software or access to cloud services. According to the authors, a significant issue is the absence of "broadband infrastructure in rural areas and connectivity to devices (for example, on a tractor, computer, tablet or smartphone that records what is happening, or a device for privacy issues of satellite photography) providing access and possession of data is one of the main issues for the accelerated implementation of the precision digital agriculture approach". Despite the stated challenges and difficulties, the main contribution of digitalization and digitization is indisputable, namely ensuring full control over the business processes that take place in the agricultural economy, as well as their maximum improvement and modernization" (Nikolov et al., 2022) [12].

Bulgarian authors claim that the implementation of digital technologies is mainly applied by younger entrepreneurs in the sector. They consider the concept of more efficient use of production resources as a way to deal with problems related to the low competitiveness of agriculture in Bulgaria. The study also found that the average prices of agricultural products in the country are lower than those on the European markets. This emerges as one of the leading reasons forcing "domestic producers to focus their efforts on increasing production efficiency in order to optimize their profit from international trade" (Doncheva & Aleksiev, 2022) [4].

**Strategic documents related to the digitalization process in the agricultural sector**

The EC reports that the EU has 10 million farmers and that around 40 million jobs in the food industry, food retail trade, and food services rely on agriculture. As a result, the food and beverage sector is a significant part of the EU's economy and is closely tied to the agricultural sector (Common Agricultural Policy – CAP) [13].

The agricultural industry is a top focus of both European and national policies in efforts to recover and transition to a more environmentally friendly economy. This includes the pursuit of a sustainable and climate-neutral EU. Additionally, the Green Pact aims to digitize agriculture as part of the economic transformation process.

The Common Agricultural Policy (CAP) has outlined the EU's strategic plans for digitalizing agriculture and rural areas during the 2023-2027 programming period. This policy comes into force and is implemented from January 2023. Its main objective is to ensure "a sustainable future for European farmers, provide more targeted support to smaller farms and enable greater flexibility for EU member states to adapt measures to local conditions" (CAP).

The CAP, in addition to providing support to farmers since the beginning of the 21st century, has also helped Europe's rural areas develop and thrive.

One of the main objectives set in the latest version of the CAP for the new programming period 2023-2027 is to strengthen market orientation and increase the competitiveness of farms, both in the short and long term, including paying more attention to scientific research, technology and digitalization (Proposed CAP Strategic Plans and Commission observations, 2022) [14]. The

agricultural sector will become more competitive and yield higher returns on investment due to increased digitalization in scope and degree, which will promote knowledge and innovation.

Increasing the degree of digitalization in the country's agricultural sector is a key element in increasing the possibility of more effective development of agrarian business and the economy of Bulgaria as a whole. The National Recovery and Resilience Plan, aims to emphasize strategically the need to "increase the sustainable management and competitiveness of the agricultural sector through measures to improve the economic sustainability of agricultural holdings and the sector as a whole in the context of climate change and the preservation of characteristics of the environment'. One of the proposed measures is precisely "digitalization of the processes from the farm to the table". The Recovery and Resilience Facility largely finances sustainable agriculture, where the allocation mostly goes towards sustainable farm-to-consumer processes. The subsidy reaches up to 19,949 BGN, aiming to encourage economically advantageous moments in agriculture – amounting to 437,383 BGN (Recovery and Resilience Plan for Bulgaria, 2022).

Agribusiness, as an invariable part of agriculture, is directly affected by economic transformation. The rapid digitization of Bulgaria's agricultural industry has led to streamlined processes and increased productivity. This has benefited various stakeholders including farmers, entrepreneurs, and government agencies. Improved connectivity and technology have also become prerequisites for success in this sector. Overall, this development has opened up new possibilities for innovation and growth.

The strategy for the digitization of rural and urban areas involves various activities focused on the potential growth of technology in the agricultural sector of Bulgaria: building and developing an appropriate digital infrastructure for communication and connectivity; investment in modernization and technologies for precision agriculture; development of digital networks and use of software applications in business management and decision-making; awareness, training and advisory services for the development of digital skills and qualifications, research and innovation, partnership for the exchange and transfer of innovations, development of infrastructure for experimentation and access to it. This concept corresponds to Priority 6 Sustainable agriculture" from the National Programme "Bulgaria 2030" and Goal 2 "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" from UN Sustainable Development Goals (SDGs, 2023) [16].

According to the Digital Economy and Society Index (DESI), which measures Europe's overall digital performance (DTI) and compares it to other competitive countries, it has been observed that some countries have experienced a decline in performance over the past few years due to the impact of COVID-19, there has been an acceleration of existing trends in the flexible labor market and remote working globally, but not to such an extent in agriculture. Rather, the trends concern individual e-commerce and home office work. The results in the 2022 DESI report testify to the progress of most European countries in the direction of digital and digitized transformation. It is notable that an increasing number of business organizations perceive the implementation and application of these innovative methods and find them a suitable way to increase their competitiveness. At the same time, the fact that the share of investors in artificial intelligence and big data remains relatively low in the leading European countries is also taken into account.

Figure 1 testifies to the presence of the most startups in the field of AI and big data. According to the statistics, there are three more areas that show a growing trend for development: advanced manufacturing and robotics, blockchain, and agricultural technology (agtech). Their number is expected to grow rapidly in future as well, as investments in these technologies are particularly intense and concentrated. From the data presented in Figure 1, there is a

decline in investment in advertising and cloud technology (adtech) and digital media (DESI, 2022) [3].

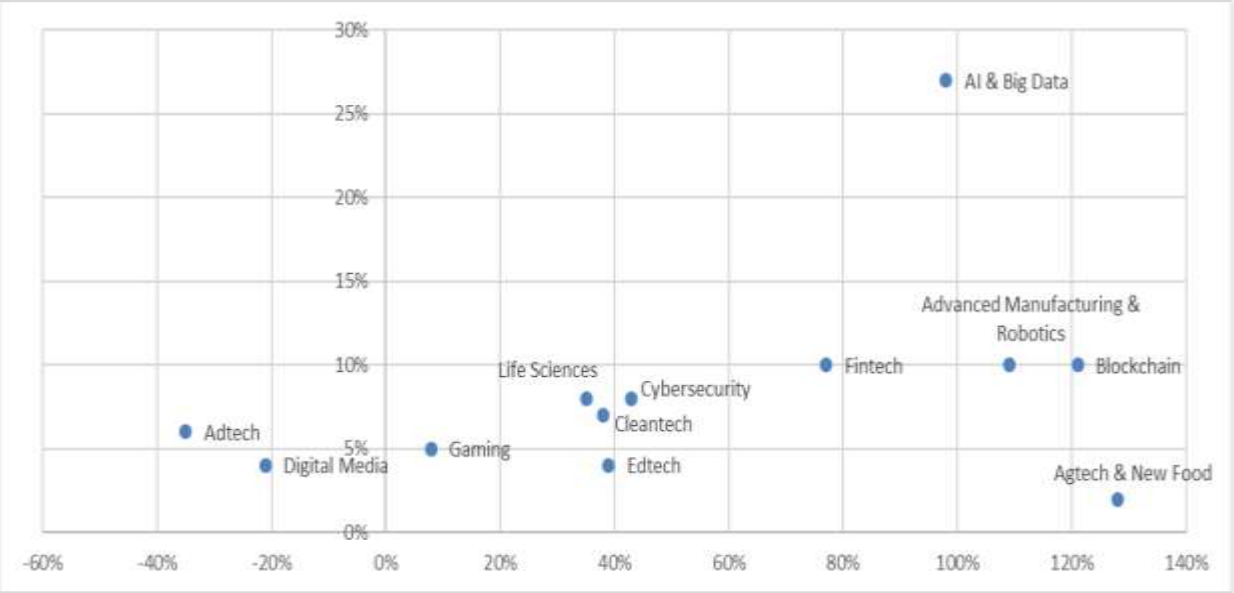


Fig. 1. Global share of start-ups vs Series A59 deals 5 year-growth in 2021
Source: Digital Economy and Society Index 2022 [3].

According to DESI data as of 2019, it turns out that our country has one of the lowest levels of using digital technologies in economy and society. Bulgaria ranked 26th among EU countries in the Digital Economy and Society Index for both 2017 and 2018. This index measures the digital economy and society using various indicators. However, Bulgaria is significantly below the EU average, especially in areas such as enterprise use of digital technology and the agricultural sector. The situation in Bulgaria is not good, and in some cases, even worse compared to other countries. A 2022 follow-up study by DESI revealed that Bulgarian households have experienced a positive trend in internet accessibility in recent years. However, significant differences have been reported, regarding digital technologies in agriculture in our country compared to other EU countries. Achieving the goals of digital economy depends on the collective efforts of all EU members. Each Member State will have to contribute to the meeting of this ambitious goal by implementing different mechanisms, based on the available resources of the State, relative advantages and contingencies, demographic capacity, the scale of the national economy and areas of specialization in the agricultural sector. The degree of digitalization in the various subsectors of agriculture is different for farms of different legal types and varies in the separate regions of the country.

With the integration of digital technologies in business activities in the economic sector, technological progress is being implemented in Bulgaria, but at a slower and more cumbersome pace of digitalization in agriculture. The implementation of cloud services, artificial intelligence and large databases of enterprises are among the lowest services in Bulgaria, compared to EU countries. To improve the situation, a voucher-based financing program was launched in 2021 to encourage and increase the technological capacity of micro, small and medium-sized enterprises and support their sustainability and competitiveness.

Bulgaria is also taking measures to encourage cooperation between research institutes and businesses in the agrarian sector. Funding is provided through state programs such as "Innovation and Competitiveness" - an operational program to promote entrepreneurship and support the creation and

development of new sustainable businesses and high-tech companies that aim precisely to implement new technologies.

Table 1. Integration of digital technology

| | **Bulgaria** | | **EU** | |
|---|---|---|---|---|
| Integration of digital technology | rank | score | score | |
| DESI 2022 | 26 | 15.5 | 36.1 | |
| SMEs with at least a basic level of digital intensity %SME`s | NA | NA | 25% | 55% |
| Electronic information sharing % enterprises | 23% | 23% | 22% | 38% |
| Social media % enterprises | 10% | 10% | 13% | 29% |
| Big data % enterprises | 7% | 6% | 6% | 14% |
| Cloud % enterprises | NA | NA | 10% | 34% |
| AI % enterprises | NA | NA | 3% | 8% |
| ICT for environmental sustainability % enterprises having medium/high intensity of green action through ICT | NA | 68% | 68% | 66% |
| e-Invoices % enterprises | 13% | 10% | 10% | 32% |
| SMEs selling online % SMEs | 7% | 8% | 10% | 18% |
| e-Commerce turnover % SME turnover | 2% | 3% | 4% | 12% |
| Selling online cross-border % SMEs | 3% | 3% | 4% | 9% |

Source: Digital Economy and Society Index 2022 [3].

The national fund includes BGN 318 million (€163 million) through four capital instruments, including acceleration, seed funding, venture capital and mezzanine funding. In order to overcome the shortcomings and problems with the digital transformation in Bulgaria and to reach the levels of the other EU member states, continuous, sustained efforts at the political and administrative level are needed, building on the country's strengths to implement reforms and investment in agriculture.

## CONCLUSIONS

Digital transformation, digitization and modernization are a key factor for the sustainable development of the Bulgarian economy in general, and agriculture in particular. These technologies are entering at a very fast pace, which will lead to new economic dimensions and opportunities for the agricultural sector. An inevitable part of this process are challenges that require a clear strategy in "supporting a smooth transition to digitization and digitization" (Nikolov et al., 2022) [12]. The adoption of digital technologies and digitization by enterprises remains at a low level, and the adoption of advanced technologies such as AI and Cloud is even lower in Bulgaria. Based on the strengths of our economy, policies aimed at the implementation of these technologies should be introduced and implemented, so that Bulgaria reaches the average level for the EU. The need to digitize and manage agriculture through modern and digital working methods is increasing day by day and leaves a huge part of the processing and production process in the hands of super computers and software applications. This part is an invariable element of the scientific and technical progress of our country, and the renewal of information flows is directly related to the optimization of the quantitative and qualitative characteristics in the production of agricultural products and protection from an increase in the inflationary risk in this industry.

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